IT STARTS WITH US

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The Human Sustainability Project

Amy Dibley, Director of Physio Direct; Louise Fangupo, Director of Thrive: Fitness, Nutrition and Wellbeing; Loshni Manikam, Director of Iceberg Coaching.

This workshop concept arose during conversations about sustainability. It's a real buzz word in our industry currently and we’re thinking about it with regard to financial factors, land use, water use and our overall industry image and marketing. The theme for this year’s conference is “It Starts with Us” and this statement is obviously very relevant when we think about sustainability in relation to the factors mentioned above. But what about the sustainability of our greatest asset – ourselves? All too often, we see top performing farmers exiting the industry or unable to continue in their current positions due to personal factors such as burn out, depression, fatigue related illness and overuse or physical injury to our bodies. This workshop brings together three experts to help draw out ideas on how we can keep our bodies and minds fit for farming forever.

Sustainable Wellness for dairy farmers.

Wellness is a term that is in regular use these days, both in the general media and within the dairy industry. But what does it really mean in practical terms?

Think of the feeling of driving a beautiful car down a long open road. The engine is humming along, beautiful scenery whipping past the window, full control of the engine is in your hands and you have nowhere to be in a hurry – Bliss?

Now imagine the same scenario, but you’re driving your old Suzuki farm truck, with the dodgy gears, slipping fan belt and creaky suspension. The scenery is the same, but some of that amazing feeling is lost, because you can’t get the same performance from this type of machine.

Now imagine your perfect driving scenario, but you have just pulled out of the petrol station about 2kms ago and have just realise you’ve put the wrong fuel in the car. Suddenly the power and performance you were longing for are gone, replaced but stuttering to a halt, a long walk home and an expensive trip to the garage.

Finally, imagine you are back in the perfect car, plenty of gas in the tank, racing along your road. Then imagine that you, the driver, are at the end of a long day, distracted by thoughts of the bank manager’s visit tomorrow and what you’re going to have for dinner tonight, suddenly you made an emergency swerve and taken a wrong turn down a rutted gravel road, and are back to doing 30km’s and hour and wishing you were somewhere else.

A simplistic analogy I know, but the point is, that the magic happens when all of these things are IN BALANCE! We have to look after our engines, our bodies with regular maintenance and repairs. We have to give our engines the right amount and type of fuel to get the job done, with maximum
performance possible from the type of engine we’ve been given. We need a competent rested driver at the wheel, with a clear plan, making good decisions about where and how we’re going. With any one of these three things out of balance, our experience is not the same.

**Preventing Discomfort, Pain, Sprains, and Strains – Amy Dibley**

So, if this year’s conference “Starts with us”, then getting the personal formula right starts with the engine. - keeping our bodies free from pain and discomfort by working smarter.

**What is a sprain or strain?**

A sprain or strain is a term used to describe a broad range of minor conditions that can affect muscles, joints and surrounding tissues from either a light injury, overuse or poor biomechanics (i.e. the way we move). Sprains and Strains can cause immediate discomfort or sometimes, discomfort and pain is what you’re left with once injury has healed due to weakness from the injured and surrounding tissue from poor strengthening and no rehabilitation, or tightness in the injured and surrounding tissues from lack of movement during the healing phase.

Discomfort and pain can build up over years, so sometimes there is not any immediate or obvious cause and there also can be a combination of a few factors.

Ordinary aches and pains usually disappear after a good night’s rest, while ongoing discomfort and pain can develop into an injury, and that can become a serious long-term problem.

**What are the stats around dairy farmers injuries?**

Most common body parts injured?

- Ear
- Lower back
- Knee
- Finger and Thumb
- Shoulder (Including Clavicle and shoulder blade)

Who and when?

- Most common group injured are males, aged 50-54 years of age. Most common time to injure yourself is on a Monday i.e. after the weekend, just before morning tea time.
How do we get Discomfort, Pain, Sprains and Strains?

Even fit and strong people can get discomfort, pain, strains and sprains if they're exposed to the right combination of factors.

These include:

- Twisting, awkward postures
- Bending and stooping for periods of time
- Repetition and over use
- Heavy weights with high forces
- From being fatigued
- Slips, trips and falls
- Vibrations
- Unexpected jarring and jolting

How do we stop Discomfort, Pain, Sprains and Strains?

First and foremost, in stopping these injuries, is preventing them. Making sure people know about the process and protocols in and around hazardous areas or doing hazardous jobs.

Also, very important is keeping a good level of general fitness, good nutrition and overall good general health and wellbeing. In other words, looking after yourself! Other things which might help include

- Some stretches to loosen tightness in muscles.
- Braces can be good to give joints extra support. Limiting range of motion to allow healing of ligaments and tendons mostly.
- Personal safety equipment such safety glasses, high visibility gear, ear muffs and safety guards.
- A visit to your GP, who can help by giving anti-inflammatories and a referral to physiotherapy.
- A visit to your physiotherapist. Did you know you don't need a GP referral to go to a physio? Physiotherapists are pain and movement experts. A physio will find out why you are in pain, help you get rid of the pain as quickly as possible, get you moving again and get you back to doing the things you enjoy. Simple.

Correct Lifting Technique.

It's important to bend you knees. Your Quads are some of the largest muscles in our body but the muscles in your back are very long and thin, nothing in comparison. Your back muscles are not built for power but for endurance. So, make sure you bend your knees and use your legs! Also try to keep the weight close to your body, get a good grip on what your lifting, keep a good strong stance and try to bend from the hips, not through your back.
Health and Well-being.

Despite a huge focus on workplace accidents and injuries in NZ, research has indicated that 6 times as many people may be dying from workplace-related diseases! So that means things like Diabetes, Heart Disease, Chronic Obstructive Pulmonary Disease, Cancers etc. When workers continue for long periods of time with poor nutrition, dehydration, working long hours, and at times are under stress, their health really suffers. With poor health there is reduced performance and decreased safety and increased injuries. Sleep and adequate rest is when your body recovers from the previous day and lack of this means less recovery.

Lack of sleep, fatigue, boredom, poor nutrition, and dehydration all have the ability to increase the likelihood of an injury occurring.

Slips, trips and falls.

- Not just for the elderly, slips, trips and falls are the leading cause of injury hospitalisation and one of the leading causes of injury death in New Zealand.
- Avoid falls where you can by using a hand rail if there is one, avoiding jumping off raised levels, keep the floor free of clutter like tools, hoses or equipment and make sure the floor surface is safe and clean from excess water, petrol, oil or ice.

Cold and Vibrations.

One of my least favourite memories of getting the cows to the shed for the morning milking was the numb frozen fingers even with gloves on! It’s actually painful!

With vibrations, gloves can act as a small shock absorber protecting the fingers from going numb.

If they do go numb or tingly, stop and rest. Move the fingers, rub them, open and close them, swing your arms in circles to help with the blood flow being careful not to give yourself a shoulder injury!

Maintain heavy machinery to reduce vibrations.

Unexpected jarring and jolting

- When you bend over the vertebra bends and flexes forward causing an increased space at the back of the disc making the outer wall of the disc stretched and weakened. When force is then added especially with twisting, this puts excessive force on the lining that can then rupture, and the gel inside can bulge out. If it’s bad, there is no fix for the ruptured disc and a surgeon will have to perform a vertebral fusion, basically wiring the vertebra above and below together so no movement then occurs at that joint.
- The second way of injuring the disc is from excessive jarring, jolting and repeatedly bending incorrectly. This can weaken the outer layers of the disc and over time be the cause of a disk
bulge. So really the straw that broke the camel's back. I've seen patients who have been bending down to pick up socks off the floor and have ended up with a disc bulge. So, these types of movements in Dairy farming to look out for are: milking cows, lifting calves, bags of grass seed, implements, gates, firewood, fencing equipment, posts, lifting a nap sack full of spray. Pretty much nearly every day to day activity of a farmer!

**Rotator Cuff injuries.**

The Rotator cuff is basically made up of a group of 4 muscles on your shoulder, one at the top, one at the front, one at the back and one underneath, that all work together. They basically make up all the movement that your shoulder can do. The shoulder joint is a very shallow ball and socket joint, which is likened to a golf ball sitting on a tee. Not a lot of surface area is actually attaching your arm to your body, which makes for great range of motion, but is also its demise and the reason the shoulder is prone to so many injuries.

The rotator cuff can be injured acutely by a fall and tear, but pain can also arise from tendon inflammation, caused by over use and repetition. The shoulder blade and the collar bone join at the tip of your shoulder and create a tunnel underneath in which the top muscles pass under. After lots of overhead activity like hanging the cups up high at the shed, reaching forwards to cup cows or cutting firewood, the tendon starts to rub on the collar bone above. This causes the tendon to get inflamed and then there is even less room for this tendon to fit through the tunnel. Therefore, the easier it rubs and the more inflamed it gets. Gradually the shoulder gets more and more painful and uncomfortable. You will know if you have this if you have pain or a pinching feeling at 90 degrees when you lift your arm up.

Rest, anti-inflammatories and rehabilitation of the other muscles in the rotator cuff can help with its recovery. If this continues, the tendon start to fray and can weaken causing a tear and then you are prone to further injury and therefore surgery. So, it’s really important to look after your shoulders and your low back.

**What to do if you have an acute injury – R.I.C.E**

- Rest – Use the other arm, take some time off or swap jobs with a teammate.
- Ice – Cold pack
- Compression – A firm bandage or support sleeve
- Elevation - Remember elevation means being above your heart. So if you have sprained your ankle, sitting in a chair and putting your foot up is not high enough. You need to lie down and have your foot on a pillow to lift it up higher than your heart.

**Your challenge: To give as much thought to your own nutrition, as you do to that of your dairy cows! - Louise Fangupo**

So now, you have a well maintained, high performance body to work with. How do we go about filling it with the right fuel to maximise our productivity through the day and our working lifetime?
You know the benefits of getting their nutrition right – what about your own? Eating well is a crucial part of the overall wellbeing picture: it has the potential to make you, and your staff and family, both happier and healthier on an everyday basis. While there’s no need for expensive supplements, detailed menu plans or fancy ingredients, there is a lot to be gained from spending some time thinking about whether you are getting the basics right. There’s also a lot to be learnt from taking some time to listen to your body – what is it telling you about your food and fluid choices?

1. **Focus on REAL FOOD**

Select a variety of nourishing foods from the following food groups, every day:

   a) Fruit and Vegetables
   
   b) Breads and Cereals (preferably wholegrain varieties)
   
   c) Milk and Milk Products
   
   d) Meat and alternatives (eggs, nuts, tofu, legumes etc.)

This may sound like boring, and perhaps even ‘old-fashioned’, advice. However, choosing a range of foods from the above groups helps to ensure that you consume a wide range of health-supporting nutrients on a daily basis, without any need for supplementary pills or potions. It also helps keep you focused on what you SHOULD eat (rather than on what you shouldn’t), meaning that good food choices often start to ‘crowd out’ poorer choices.

2. **Stay well hydrated**

Dehydration affects your ability to perform both physically and mentally. Individual fluid requirements vary greatly, based on factors such as body size, activity levels, environmental conditions, and sweat loss. It’s possible to estimate your approximate daily fluid requirement by multiplying your weight in kilograms by 35ml, but it’s also important to pay attention to internal cues: are you thirsty? Is your urine concentrated? Are you losing significant amounts of weight in short periods of time when working hard on the farm? If so, you may need to drink more. While water and milk are generally your best choices, during periods of extremely physical work electrolyte replacements and/or sports drinks may be justified.

3. **Look out for, and listen to your body**

Think of your body as both your best mate, and your best asset. Respond appropriately to feelings of hunger, thirst, and satisfaction, and realise that these will vary from day-to-day and season-to-season. If you are making any changes to the way you eat, take time to consider whether you can imagine still maintaining them in five years’ time (sustainability is key!). And keep it all in context – if you are making good choices 80-90% of the time, there is still space to choose some food and drinks purely because you enjoy them, while maintaining good health.
4. Put the theory into practice

When it comes to nutrition, the saying “Failing to Plan, Is Planning to Fail” really rings true. Those with the best eating habits tend to spend at least a few minutes each week planning their meals and deciding which drinks and snacks to have on hand. Knowing what’s in season, having a shopping list, and planning ahead (i.e. cooking some extra meals over winter, to freeze for use in those busy spring months) will also go a long way to ensure that your nutrition knowledge is being put into practice. Invest some time into getting things right and it will pay dividends both now and later!

Please note that this advice is general and is not intended to replace individualised advice from a New Zealand Registered Dietitian. Please seek expert help if you are unsure of your personal nutritional requirements and how to meet them.

And what about the driver? You have a performance body, all the right fuel in the tank but how to steer, navigate, apply the brakes and change gears when required? For the notes on Loshni Manikam’s section of achieving and maintaining a healthy headspace – go to www.SIDE.org.nz.
Shape a Future that is Important to you - Couples Style!

Dylan & Sheree Ditchfield. Wendonside, Southland

Is happiness a journey or destination? And, what is success?

How we viewed Success

For many years we viewed success as striving to reach our goals (farm ownership, equity, financial freedom, money, profit and performance) and each time we would reach the goal, it wasn’t the elated sense of satisfaction we pictured it was going to be. The experience if recognised, was short lived and didn’t last, and then we were onto the next thing that had bigger, better financial drivers. We thought this was the measure of our success. But as our business grew we kept hitting ceilings, tackling the same problems, and slowly but surely, we were wearing ourselves out.

On our journey involving a large-scale partnership, outright farm ownership, and multi farm ownership, it was taxing, stressful, chaotic, unsustainable on multiple levels, and it wasn’t people friendly, as we were continually setting our people up to fail, and this was frustrating.

Pivotal moment

By far the biggest pivotal moment in our journey in business, life and leadership to date was during the 2008-09 global recession. We had been in outright farm ownership for four years and just prior to the recession, invested heavily into two other farms. Within 6 months after the recession hit, we found ourselves at the bottom of “The Valley of Despair.”

![Dylan & Sheree's Business Resilience Journey](image)

**Figure1.** The Valley of Despair
The Rebuild

Once we were at the bottom of the valley of despair, we put our hand up and got some help. We found a business coach, Brendon Harrex, and put an advisory board around us. Then we started the process of tipping of our business on its head, so we could gain the traction needed to start our new journey, the climb out of the valley.

Vision, Purpose and Values

Discovering our Vision Purpose and Values (VPV) was an important part of that rebuild. The key part to note was this process was a *discovery, not a creation*. It was all very foreign to us.

So how did we discover our VPV? As individuals we thought back to times when we were at our best, what did that look like? We asked each other. We asked our family, friends and team. We also asked, at pivotal times in our lives, how did we behave. What things or behaviours annoyed us the most in other people? What did others see in us that we didn’t see in ourselves? Once we started to discover and understand what our own VPV were, we brought them together as a couple to find the alignment of our values. This was thrashed out and debated again asking friends, family and our team on their views, until we were satisfied that we had discovered the VPV that best described who we were and what we stood for as individuals, as a couple and as an organisation.

<table>
<thead>
<tr>
<th>Table 1. Dylan and Sheree’s VPV (document)</th>
</tr>
</thead>
</table>

| VISION  |
| why we exist |
| POSITIVELY IMPACTING PEOPLE |
| CORE PURPOSE  |
| how we do it |
| EMPOWER AND ENABLE CAPABILITY IN PEOPLE |
| CORE VALUES  |
| what we live by |
| EMP | POWER |
| EMPOWERMENT/EXCELLENCE  |
| Equip with skills, vision and values. |
| Pursue excellence and maintain high standards in everything we do. |
| MAKE IT HAPPEN  |
| We encourage individual initiative. |
| PASSION  |
| We love what we do. |
| OPINION  |
| Be true to self – have an opinion. Be authentic. |
| WISDOM  |
| Life long learning - hard work and continuous self improvement. Two-way learning. |
| ENVIRONMENT/COMMUNITY  |
| We positively impact our environment and community. |
| RESPECT  |
| Individual respect and empathy for others. We look for the best in others. |
| We honour our commitments to others. |
Implementation – Living your Values

Once we were happy we had found values that represented who we were, it felt different but right. In the past the same values were there, but we hadn’t really named them. Therefore, when our values were being compromised, it didn't always call us to action. Now that we have named them, we don’t even think twice. We made it known to our team that this is who we are as an organisation and this is how we behave. Initially we had to over emphasise and over communicate it, but most importantly we lived the values every day. It's the first thing we talk about when we recruit, and the most important thing we recruit on.

We know now that our VPV are now our “true north”, “our boss” and the values piece of this is our drafting gate when investigating new opportunities, when recruiting, and when we are looking at potential partners or just looking at people we want to associate with. We live this everyday in every part of our lives, whether its kids, community, business, team, family, or in a public forum.

Family – Our values are a strong part of our family. Our kids know through family conversations and how we live them, what is acceptable and what is not. If any of the values have been compromised, then we have those difficult conversations with values always as the focal point. We now see our children living the same values in amongst their peers and having the courage to speak up or being empowered to walk away if they feel their values have been compromised.

Sports, Rugby – For the past two years Dylan has help his sons 1st XV rugby team discover their own vision and values. He has also helped the team install accountability on these values. The team’s recent success has been unprecedented in the school to date.

Farming Team - When a member of our team has compromised the values of what our organisation stands for, straight away we have a values conversation. If its repeated, then the conversation then becomes about acknowledging the persons values misaligning with our organisation and they may need to consider looking for an organisation with values like their own, because they are simply do not fit with us.

Meetings - At numerous public or community meetings where the direction of the discussion is compromising the organisations values, we now muster the courage to speak our views even if it seems that we are the minority. This normally very quickly seems to realign the discussion and keeps the conversation above the line.

Farming to Freedom Course

Now we have developed a business course for couples in agriculture called “Farming to Freedom”. In the course we have developed and teach eight different modules or aspects of our business that we believe are vital to implement into your life and business to achieve long lasting sustainable growth and resilience. As the modules are taught, the participants implement the learning over a 10-month period
into their lives and business. The very first module we teach is how they discover their Vision, Purpose and Values. As we have helped of the couples make their own discovery, some of the comments we have received back have been “thank you, you have made our lives feel right now” and “It is SOOO us, we now know that feeling!! Until it happens you never expect this feeling!! Even when you have told us. Thanks for all your help.”

**Measuring Stick**

What is your measuring stick? Why can’t we move from being results focused to having a values focused outlook to measure our sense of self-worth? Do we have to measure ourselves by materialistic things? Ego in our dairy industry has been very destructive and responsible for a lot of present serious industry issues, like depression, wellbeing and indebtedness. We must do something different in order to get a different result!

**Happiness?**

So, coming back to the “happiness is a journey” statement. Isn’t happiness a moment in time, therefore a destination? Is it not fulfilment and contentment we are seeking on our journey? When our actions align with our values, the journey life is, becomes a truly fulfilling and enriched experience. Is this not what success is?

To summarise, there are different ways you can discover your values, and you can associate them to you as an individual, couples, groups or organisations. It doesn’t matter how you get there, what matters is that you discover who you really are and what you stand for, and your behaviours mirror these.
How bio secure is your business?
Andrew Muir, Veterinary Centre Oamaru

Summary

- Biosecurity is a way of reducing the spread of new diseases onto a farm.
- It can make good economic sense to put biosecurity controls in place.
- Cattle, people, and equipment are the 3 broad categories of biosecurity risk.
- Identify the risks for your business and identify practical ways to mitigate them.

Introduction

Since the detection of the exotic disease *Mycoplasma bovis* on a South Canterbury dairy farm in July 2017 there has been a heightened awareness of biosecurity on dairy farms. The awareness has stemmed from realisation of what the implications could be if this disease were to be discovered on people’s properties. Farmers can see the benefit of making their farms more resilient in the face of potential exotic diseases like *M.bovis* but also the endemic diseases and pests that are already in New Zealand.

What is biosecurity and why is it important?

Biosecurity is the strategies taken to prevent the introduction of unwanted diseases or pests and control their spread (Wells, 2000). We are most familiar with biosecurity at the national level, e.g. the screening of people as they arrive at the border for dirty shoes or carrying unwanted food items that could potentially carry diseases like foot and mouth. The Ministry for Primary Industries (MPI) is responsible for the border control. They also respond to incursions of exotic diseases when they have made it across the national border. Biosecurity is also coordinated at the regional level, with movement control and pest eradication for Tuberculosis (Tb) control the most recognisable example.

Relying solely on biosecurity at a national or regional level leaves farms vulnerable if a new disease or pest manages to get across the border. Having robust farm biosecurity procedures in place strengthens our national biosecurity as it will slow the spread of any new disease that does manage to make it into New Zealand (Sibley, 2010). Biosecurity at the border also does nothing to address the diseases and pest that are already endemic in New Zealand. The diseases already endemic in New Zealand can have multiple effects on a farm including, economic though lowered productivity, cost of control and lowered value of stock. They can also cause animal welfare concerns which are important for ethically, legal and market access reasons. Finally, they can also cause human health concerns for farmers their staff and families but also the end (Beef &Lamb and Deer Industry New Zealand, 2013). While it may not be possible to stop all infectious disease and pests at the farm gate it is possible to reduce the risk of many of them entering your farm.
Biosecurity risk areas

Implementing a biosecurity plan involves completing an assessment and estimating the likely significance of each risk for your farm. It isn’t feasible to eliminate all risks but to make an informed plan after defining what the risks are (Wells, 2000). It is rational to deal with biosecurity risks that have broad effects on the control of many diseases that are either exotic or endemic to the herd and are easy to implement and continue with (Sibley, 2010). It helps to have an understanding of the epidemiology of any particular disease you are trying to control.

Biosecurity risks can be broken into three broad groups, cattle, people and equipment/other. (Sibley, 2010). Within these three areas I have attempted to outline common biosecurity risks to consider, when putting together a biosecurity plan.

Cattle

In general, movements of cattle are the greatest risk for the introduction of unwanted disease. This is because a large number of diseases don’t survive for long periods outside an animal host and require close contact to spread. The closer you are to running a truly closed system the lower the level of risk will be associated with this category.

The following are potential stock movements to consider:

- Newly purchased or leased stock, including bulls or lease cows that are returning.
- Animals returning from grazing, this includes heifers, calves or cows being wintered.
- Animals that have escaped across the boundary fence to the neighbours, or vice versa, neighbours cattle that have access onto your property.
- Points on the boundary where cattle have nose to nose contact with neighbouring stock.

People

Some diseases can be transmitted outside of cattle and so could be introduced onto a farm with people. In general the level of risk is lower than that of stock movement, however if people coming onto the farm have a lot of contact with the stock they are of a greater risk than people that have no contact. If the people coming on farm are going into the areas that cattle graze they could be a risk factor depending on the disease or pest.

Potential risk areas include:

- Staff that work on farms other than your own e.g. relief milkers, calf rearers and casual staff.
- People who are there to provide a service for your cattle, e.g. AI technician, embryo transfer personal, veterinarians, foot trimmers, stock agents, pregnancy scanners, groomers for shows, milking machine technicians.
- People who are employed for other reasons on farm e.g. fertiliser spreaders, agronomists, people to service irrigation and or effluent, silage and agricultural contractors, electricians, and builders.
• People that are coming onto your property for other reasons e.g. bee keepers and regional council, people buying calves.
• Can you control the movement of people onto your farm, are there multiple entry points or can the public freely access your property from walking and cycle tracks or other natural features like rivers or beaches?

**Equipment or other vectors**

Any equipment brought on farm that has been to another farm (either in New Zealand or overseas) carries an element of biosecurity risk. Items that have direct contact with cattle generally have a greater risk of introducing disease compared to equipment that has no contact with stock or the areas they graze. Equipment sourced that has had no contact with other animals, effluent or animal products before arriving will have a low risk.

• Equipment that has direct contact with stock e.g. pregnancy scanning equipment, calf debudding equipment, A.I. pistolettes, hoof trimmers, scales and platforms, calf trailers, stomach pumps, equipment to restrain animals and calf pullers.
• Personal protective equipment (PPE), e.g. gumboots, overalls, shed aprons, milking sleeves and wet weather clothing.
• Vehicles, any vehicle that leaves the tanker track and goes onto the farm where cattle graze. These can also be a potential source of unwanted weed species if they are dirty. E.g. any silage or cultivation equipment, any vehicles driven by service personal, vets or regional council inspectors. Stock trucks are a risk due to the contamination of them by animal secretions or excrement.
• Effluent spreaders.
• Calf bedding. Items like wood chips, shavings are probably low risk items.
• Feed brought on farm. Any food that is sourced off farm and brought on farm is a potential risk. However, this will depend on where they are sourced from and how they are treated prior to arrival. Calf milk replacers as they are heat treated, would be very low risk. However whole milk especially milk from sick cows or animals under treatment is a much higher risk. Fodder beet crops that are lifted and brought on farm would be a low risk for the transmission of animal disease but a potential risk for weed species.
• Other animal species like rodents and possums are always a potential risk for the transmission of disease e.g. leptospirosis or tuberculosis, depending on your farm location. Other animal species like birds or other stock types are a potential source of disease.
• Yards at grazing blocks.

**General biosecurity control measures**

When putting together a biosecurity plan for your farm, it is worthwhile getting input from your vet, they will be able to provide information on the epidemiology of any diseases that you are trying to control with a biosecurity plan. Also refer to the Dairy NZ Biosecurity WOF and the Morven Action
Group Biosecurity Plan, these contain check lists of risks to consider. The following are some general recommendations to mitigate the most common biosecurity risks.

Start by setting up biosecurity zones on your farm. The zones control what movements of, stock, people and equipment can occur in various areas and sets the corner stone for other biosecurity controls. The principle of biosecurity zones can also be applied with graziers on their farms or on run offs. (Morven Action Group, 2017)

The 3 zones to divide your farm into are:

- Green zone: the areas where no stock will enter, like the tanker track or driveways to houses. The public can arrive and not be a biosecurity risk.
- Red zone: the area of the farm where stock graze or effluent is spread. No access is permitted unless people and equipment have followed the biosecurity procedures for the farm.
- Blue zone: An area between the green and red zones. A place to quarantine incoming stock, place pet food animals, sick animals or animals that have turned up from a neighbours. This can be a small area.

Have a map at the disinfection area to your farm which shows the above areas and biosecurity requirements of them. A health and safety sign could be incorporated with it.

Cattle

- Ensure that animals have NAIT tags and all movements are recorded. Ensure that Animal Status Declarations (ASD) forms are fully and accurately completed.
- When purchasing or leasing cattle find out about the herd health of where they have come from. Stock coming from multiple sources, a sale yard or someone trading cattle is much greater risk than coming from a single source or a closed herd. Use a pre purchase check list to ensure you ask about any diseases of concern and ask for verification of health status from the agent.
- If cattle are run with a grazier, either young stock or over the winter, discuss with them how to manage biosecurity risks. Specifically discuss how to prevent nose to nose contact of stock and what is going to happen with sick animals on farm.
- Don’t milk any cows that slip over the winter on other farms, or vice versa.
- Ensure boundary fences are secure and prevent nose to nose contact. This can be done by coordinating grazing with the neighbour or erecting a temporary fence that is at least 2m off the boundary (Morven Action Group 2017). A more permanent option is to plant a shelter belt. Consider anywhere that stock are going to have nose to nose contact with other farmers stock e.g. when grazing road sides or walking to winter grazing.
- When new stock or stock from grazing arrive back on farm keep them separated from the rest of the herd for a minimum of 7 days. Monitor them closely for signs of disease while in the quarantine period. Keep them in the blue zone.
People

- Have only 1 access point to your farm so people movements can be controlled.
- Set up a disinfection station at the entrance to your farm. Ideally have a boot wash that is a 2 bath system, one to remove organic matter and the second to disinfect them. Have a scrubbing brush and spray container for use on personal protective equipment. There are many disinfectants that can be used but make sure you find out how long they are effective for. Ensure that there is clear signage.
- Have another boot wash at the shed so that people can disinfect PPE when leaving the farm.
- If you have casual staff or staff that work on other farms supply them with PPE for use on your farm. Make it clear to them that this equipment is only to be used on your property. Potentially this could be extended so that all people coming on farm use PPE that you supply.
- Ensure that all people who come on farm are wearing clean PPE that is disinfected.
- For critical areas like calf pens don’t let anybody but the calf rearers into them. Move calves that are being sold at 4 days of age to a pen in the blue zone for people to collect.

Equipment

- Firstly look at all equipment that comes on farm and assess the potential risk of it. If it isn’t necessary stop it. If feasible you may be able to purchase your own gear to keep on farm e.g. calf pullers or stomach pumps. For everything else, ensure that it comes on farm clean and disinfected especially if it has direct contact with stock.
- Limit the access of vehicles into the red zone of the farm. This may mean providing a vehicle for contractors, that they can use, when feasible.
- If contractors have to take their own vehicles on farm (into the red areas) ensure they are clean prior to their arrival. Provide a wash down area for contractors leaving the farm i.e. a wash down hose and disinfection.
- Ask for all transport trucks to arrive in a clean state. Consider disinfecting the truck in the areas where nasal and oral secretions may be before loading stock.
- Don’t allow effluent or waste milk to come on farm from other properties. Ensure that any calf bedding that comes on farm is unused.
- Have rodent control measures in place, especially around the dairy shed, feed storage areas and calf pens.
- If you are sharing yards with another farm, for example at a graziers, coordinate any use of them so that there is a stand down period. 24 hours may be practical, but longer time periods, 7 days may be required for diseases like BVD. Consider spraying yards with a disinfectant on the areas where there may be saliva or secretions that could be licked by other cattle, especially areas of pressure.
References


Welcome to Milk, Mussels or Midlife crisis

My girlfriend Helen and I have 4 children: Nick, Maegen, Emma and Art.

Today we are sharing our personal story of our dreams, adventures, family journey and our business growth with you. We hope you will relate to our story and get inspiration from our journey.

Milk because we have been part of the Dairy Industry for 22 years, mussels because we are involved in the mussel industry and midlife crisis; because when the kids have to explain why we are moving and changing, they say that we are having our mid-life crisis.

Our story – 4 themes

1. Challenge
   Series of challenges, events, and decisions, struggles, milestones that have challenged us and given us confidence to keep going.

2. Change
   Looking back on our journey of change – some big life and business decisions.

3. Confidence
   To do something different and keep learning which helps us to stay focussed on the positives plus provide the satisfaction to stay mentally and physically well.

4. Wellbeing
   Along the way, we’ll track our journey on a graph – to show what has lifted us.

The future?

We’ll also share where we are right now and try to make some predictions about what the next stage in our ‘midlife crisis’ is going to bring.

Your turn – ‘Tracking your journey’

This part is about you – it will be a chance to think about the decisions that you have made and the events that have given you a lift, given you energy and satisfaction and then create your own graph.

Our story

As Southland dairy farmers for more than 20 years, how did we come to live in a lodge - accessible only by boat - in the Marlborough Sounds? And how did we become involved in aquaculture and tourism - a diverse mix and a challenge that we and our 4 kids relish.

We have owned our mussel business for a year and a half and have re-branded it to Mills Bay Mussels. We’ve opened a café where we can showcase and celebrate mussels. We employ a team
of 10 people, sell 500 ton of life mussels into the South Island and Lower North Island. We have fallen in love with mussels and it really excites us.

We are passionate about farming; dairying is a great industry and has given us unbelievable opportunities. However, we have taken a few knocks along the way and there are many things that effected our personal wellbeing; we’re sure you can relate to this;

- Always being busy and then noticing that the kids are growing up to fast.
- Farming becomes repetitive; same stuff, different day.
- Also, we are commodity price takers and there is mounting pressure in the environmental area, human resources and a squeeze on profits.

Balancing all this was slowly killing our passion for farming, we could only absorb so much.

We want to share how we deal with this, how to get new energy and how we broaden our horizons.

We’ll follow a graph that shows that our personal wellbeing comes from keeping the momentum of change going, that we have found something that gave us energy before we got worn out, that we have grown enough confidence to go and do what we want to do.

There are some flat parts in our graph and there are plenty of jumps. The flat parts reflect our struggles, but looking back some of them were milestones. The ‘jumps’ come from continuous learning and putting it into practise and also from focusing on our family values. Having a strong belief in each other in other people and smart work take us to that next level every time.

Looking back, making a graph and thinking about our journey gives the confidence to jump forward.

HELEN

Thanks Art for the introduction. I love coming to these types of events and getting inspired; I am thrilled that I get the chance to stand up here and share our story.

I will touch on some of the jumps and lifts that Art talked about and that show in our graph and the journey how we got there.

So back to the very beginning of our story...

In 1995 Art and I met at Uni, where we were both studying agriculture. The plan was to take over our families’ dairy farm in The Netherlands after uni. However, before we were going to do that we both wanted to go on a big adventure with a large dairy farming element and see more of the world.

We heard some great stories about New Zealand, we applied for a job in Ashburton and set-off to do a year as farm workers. We wanted to learn as much as we could about dairy farming in New Zealand, so we could take this knowledge back with us and apply it to our home farm. It only took us two months to realise, that we loved New Zealand and why would we go and farm in Europe if we could be dairy farmers here in NZ. It took us another 3 months to find the courage to ring home and tell them we weren’t coming back. My dad wasn’t too sure about these 21-year-olds staying away, so
he booked a ticket and came to see us. He loved it; he gave us the best endorsement; he said: “If I
was young, I would do exactly the same’.

Aged 21, We started with a dream; a big dream to milk 1000 cows and have 6 kids at the same
school;
So, we thought; we better get on with it!

We worked on our dream together. We had 4 children in the next 7 years making the Blom Clan 6.

Through lots of different structures and opportunities we found ourselves to be the proud owners of
three dairy farms totalling 1000 hectares with 1500 cows.

That’s where it got hard!

We were trying to make a go of family life, manage lots of people; work the land and take care of the
cows and unfortunately things didn’t go the way we wanted to.

We were doing a lot of crisis management and we didn’t feel we were living our values or making
progress for that matter. We didn’t get to spend the time with the kids and things felt out of control.
And then there was always the debt pressure; 750.000 milk solids and a 20-million-dollar debt made
for many sleepless nights.

We knew we had to change what we were doing. We had to come up with a new plan where we
would come out at the other end still sane and with our equity preserved! It also had to fit within our
family values which are based on having fun together, celebrate, love and encourage each other, and
do things for the community together.

The plan was simple – sell some land, reduce debt and to celebrate we would realise another big
dream: Take the kids on a trip around the world for a year.

How were we going to make all this work? We recognised we needed good people and whole
new robust systems. That’s where our focus went for the next two and a half years.

We formulated a powerful but simple business focus/mission, so everyone could relate to it and use it
in their decision making every day:

Long term employment grow & eat as much grass as possible.

We underpinned that with our professional values which are: team spirit, doing what is right,
challenging boundaries and making it happen.

After 30 months of hard, focussed work, the day came that we had two farms sold, we had a fantastic
team to run our two dairy farms and smaller run-off and our oldest child was 15, young enough to
catch up on 6 months of level 1 NCEA exams.

It was finally our time to go on the big adventure that we had been dreaming of and most importantly
let ourselves enjoy this special time as a family. We named our little group: “Adventure-is-us” and all
of us were allowed to choose a place or country that they really wanted to visit. Choices included; Machu Picchu, cycling in Vietnam, the Amazon in Brazil, camping in Africa, sailing the Mediterranean. We planned and booked it; This was actually happening!!

ART:

While we were away we still had two dairy farms and a run-off to govern. Despite being half a world away from New Zealand we managed to make it work.

A year sounds like a very long time to be away from the farm. A weekend away, or maybe a week away from the farm used to be a long time. But we found if you are going to be away for only a couple of days, you prepare enough to only be away a short time. If you know you are going away for a long time you prepare different for that and you start behaving that way. No short cuts and good systems.

Together with the team we had developed a communication system where the manager and the rest of our team took real ownership of on-farm and financial data. It included clear expectations, targets and a detailed budget. We could access simple but detailed reports on drop box anywhere in the world.

HELEN:

11 months after we had left on our big adventure we found ourselves in Sydney. Here we really took some time together to sum up the highlights of our world trip; we agreed that being together a lot, getting to know each other better and getting along very well made the trip so great. People on the trip were a highlight; being with people, meeting people, talking with people, making new friends and rekindling old friendships. All the active adventures that challenged our comfort zones; sailing, surfing, biking, ice hockey, all featured highly. We all got to feel Chillaxed and enjoyed the fact that everyday turned out different than we expected; almost always better. And of course, there was delicious FOOD everywhere!

So, what did we learn from this family adventure?

When we came back from our trip we had lots of new ideas, knowledge, and inspiration for the next dream.

The main lesson we wanted to hold on to was that our team on the farms had performed really well without us physically being there. The farming business was successful when the team got the chance to take on lots of responsibility with a good support system around them.

We were careful not to go back into the day-to-day of the farm; we spent time refining those support systems and looked forward to where our lives could and would take us next- perhaps a different place to live with different opportunities for us all.
We knew we loved living and farming in Southland, however Marlborough always had a ‘pull’ on us. We loved holidaying and sailing in the sounds and fell in love with the water and the native bush. So why not try to combine farming and our adventurous outlook on life?

ART:

So, where to next? We had another decision to make

Dairy farming had given us opportunities and equity to explore a different lifestyle. We wanted more family time and opportunities for the kids to be involved more in the business. So, we went looking for a good base to live and for business opportunities that would allow that. In the Top of the South we found tourism, viticulture, forestry and aquaculture.

Aquaculture sounded like fun, so I registered for the mussel farming conference just to get an idea of what it is all about. I talked to several people there and asked them; ‘if you were new in the industry, what would you do?’. Ok, so most people just shrugged and walked away, then there were also a few who went into lots of technical detail about export opportunities. I went home with a lot of food for thought anyway. A few weeks later I got a phone call that a small life mussel distribution company was for sale in Havelock; the Hairy Mussel Company. We obviously had some good laughs about the name!

Why mussels?

We brought a lot of transferrable skills from dairy farming into mussel farming and the mussel business; however, it is still a steep learning curve; marketing, branding, value-add and we love it! We are doing this because we saw a business opportunity, it is a cashflow business, we add value to our product, we work directly with our customers and consumers, it is new challenge.

Our mission is to put the green lip mussel on people’s plates as a super food. Mussels are somewhat like milk, they are seen as a commodity product and are undervalued. We don’t want to sell our mussels as a commodity product, we want to add value to our mussels. Our inspiration comes from brands like Lewis Road or Pic’s peanut butter.

HELEN:

When we were exploring different options, we walked into On The Track Lodge in Nydia Bay by chance. We really liked it and it was on the market. In the school holidays that followed we planned a hiking trip with the kids and walked the Nydia Track and stayed at the same lodge; we had some great family conversations and made long lists of pro’s and con’s. Despite the cons, all six of us agreed that we really wanted to buy this and live here.

Nydia Bay felt like that really strong foundation, that really good base we were looking for and our 4 kids went on correspondence school for that first year and we filled our days with schooling, learning about remote and off the grid living and living with the tides, supporting people on the farms,
hospitality, the mussel business, and fishing of course. It’s another adventure which connects us as a family.

On the farm the kids were always involved; driving the tractor, shifting fences, rearing calves, drenching and all sorts of other farm work. They were skilled at picking up sick cows or working out pasture covers. We really enjoyed having them around and seeing them grow. With our new tourism and mussel venture they are involved again in different levels; the cool thing is that it is new for all of us, so we are all learning together. Maegen oversees branding, marketing and the café, Nick was involved with instore demo’s, Emma helps at the lodge and in the café and Art is going to launch his own line of burley; the Blom Burley Bomb!

One of our family values is to inspire and empower each other to realise our dreams. We followed our dreams, they give us excitement and when they come true they give us inspiration and confidence to keep going; except the six kids part of the old dream. The kids have their own dreams and aspirations too which is exciting, and we are sure will bring many more adventures.

ART:

So where is our Milk mussels and mid-life crisis journey going? What is next on our graph? The challenges, struggles and milestones have helped us to make our journey of change, we made some big life and business decisions. These have given us the confidence to keep going, to keep learning and give us satisfaction. Personal wellbeing is intertwined in everything we do.

We don’t know what the next part of our midlife crisis is going to bring: We do know that we want to be respected employers, have 5% annual equity growth, together create business opportunities with our children and do all this within our family and professional values. We also want to continue to enjoy the journey!

ART:

Your turn – tracking your journey

>> Audience make graph

ART:

Looking at your graph; what does your graph tell you? What does it show?

Look at the trend in your graph, does this give you the confidence to keep going, keep the momentum going? Keeping this going balances out the negatives, the feelings of being swamped and overwhelmed.

Your personal wellbeing is affected by negative events, flat parts or dips in your graph; take another look at your graph and think about how you have dealt with these situations. If you feel stuck and sucked into a negative space, get in your imaginary helicopter, and look at this big picture and see what you really have achieved.
Ours gives us a real sense of achievement, this sense of achievement gives our personal wellbeing a real boost.

Everyone can make change; big or small; it doesn't have to be as drastic as ours! Everyone here can do things differently to balance your business, family, health, and personal wellbeing.

And remember; Mills Bay Mussels, always fresh, always good!
There are heaps of folk in the South who are helping make and take the dairy loved around the world, to the world. We raise our cheese rolls to them all.
The Future of Food
Mark Robinson, Fonterra Cooperative Group, New Zealand

Introduction

The world is changing at a rate unprecedented in history. In one 12 month period the world saw the following disruptions:

- **Transport**
  - App based rental bikes with app based locking mechanisms - China
  - The launch of a peer to peer ride share service - USA
  - App based motorbike transport, courier and shopping services – Indonesia

- **Cashless Society**
  - Apps replacing supermarket check outs
  - Mobile credit card and payment apps allowing your phone to pay
  - Payment facilities on social media platforms

- **Agricultural Innovation**
  - Vertical farming – USA
  - Urban Farming - Self-sufficient Retirement Community – Singapore
  - Floating Dairy Farm – The Netherlands

What's next?

Trends and Disruption Globally

The mega trends driving the pace and scale of change:

1. Technology
2. Urbanisation and rising middle class
3. Globalization
4. Healthy Ageing and Millennials
5. Health and Wellness

There has been a paradigm shift in business models enabled by technology brought to life by examples like Facebook (world’s most popular media owner), Airbnb (world’s largest accommodation provider), Alibaba.com (world’s largest retailer) and Uber (world’s largest taxi company) where the traditional asset ownership model has been transformed.

The speed at which people are adopting ideas and the pace at which companies rise and fall has also transformed based on these disruptions. We will explore some examples of this and look at a number of relevant case studies.
How the food industry is being disrupted with a focus on dairy

Using a number of case studies, we will look at:

- How we farm – farming systems and models
- How we grow - synthetics and plant based proteins
- How we manufacture – automation and AI
- How we get it – supply chain disruption
- How we eat it – DNA profiling and personalised nutrition

What Fonterra is doing to keep up and stay ahead of the disruption

Learn about Fonterra’s internal disruption programme which spreads the disruptive mind-set across the Co-operative and Fonterra Ventures which ensures Fonterra is partnering with some brilliant external businesses both here in NZ and abroad to lead tomorrow’s thinking.

An exciting and thought provoking workshop which will highlight some challenges, threats, and opportunities you may or may not have thought of….
Life with MAR(S) – Integrated Water Management

Bob Bower and Clare Houlbrooke

Principal Hydrologist, Christchurch and Senior Hydrogeologist Hamilton, WGA NZ

Forward

This presentation will provide an overview of a set of tools called Managed Aquifer Recharge (MAR). MAR is being used in some catchments in New Zealand to help capture and replenish groundwater supplies for the purpose of improving groundwater storage and water quality. The talk will facilitate an open discussion covering the basic principles, some specific physical techniques being applied in the Canterbury and Gisborne regions, the risks and how MAR might be used to address water management issues in other catchments in New Zealand. It will be presented in a workshop format with a focus on working with the audience to openly discuss the technical, social, and environmental issues and opportunities associated with the application of MAR.

Introduction

New Zealand is predicted to face greater and greater uncertainty regarding weather patterns, river flows and overall water reliability. This past summer, significant shifts in regional rainfall patterns had Southland fluctuating from extreme drought conditions and water restrictions to substantial late season rainfall resulting in a ‘roller coaster like ride’ for on-farm water users. Farmers lacking the capacity to irrigate from a reliable water source faced significant challenges to their farm’s production and makes planning for the future difficult.

Groundwater Storage and Managed Aquifer Recharge

The development of reliable, cost-effective storage is critical to enabling New Zealand to prepare for these water scarcity challenges. Balancing the economic, environmental, and social costs of developing storage options demands that we develop innovative solutions. Whilst both the challenges and opportunities arising from surface storage schemes (e.g. dams) are well known and highly emotive, the concept of actively managing the storage of groundwater is a relatively new for New Zealand.

Manage Aquifer Recharge (MAR) is a set of physical tools applied to various physical environments to proactively capture and recharge clean water to underlying aquifers, and has been used internationally to better utilise groundwater supplies. A global inventory of Managed Aquifer Recharge (MAR) sites is maintained by UNESCO. It lists over 1,200 programmes in over 50 countries showing a wide range of water management applications including groundwater storage and improved groundwater quality. In

1 https://www.un-igrac.org/ggis/mar-portal
places like North American and Europe, MAR has been used for over a hundred years to proactively replenishment groundwater supplies for a wide variety of purposes including potable drinking water, improving water quality and stream flows, and managing underground storage for long term water shortage plans.

Aquifers provide many advantages as a storage system. Often they hold vast volumes of water that are accessible over larger, distributed areas making the recharge and recapture of water cost effective, when compared with more traditional dam-and-pipe schemes. There is little evaporation and the perceived ‘losses’ of recharged water can often be attributed to the other potential beneficiaries of a MAR scheme including providing consistent baseflows to streams and rivers that work to restore or protect environmental and cultural values.

As a form of storage, international studies have demonstrated that MAR programs or Groundwater Replenishment Schemes are, on average, 75% cheaper to develop than more traditional water infrastructure storage options (National Water Commission, 2009). Furthermore, underground storage capacity can be developed at less than half the cost of surface storage facilities without undesirable environmental consequences or evaporation losses (Kahn et al., 2008). Irrigation investment can also lead to water-quality decline, through encouraging land use intensification. MAR schemes can help to offset the effects of increased pollutant loads to aquifers, through targeted recharge of the aquifer with clean water.

Some of the challenges faced by MAR projects include the lack of the general publics and even some water professionals understanding of groundwater and aquifer systems. Groundwater for many remains a mysterious ‘black box’ where the drilling and pumping water from a bore is an accepted practice, but the concept of proactively recharging the same aquifer to maintain supplies is harder to comprehend.

Like any water infrastructure project, proper operational and maintenance is required on MAR projects which avoids issues such as clogging which reduces the efficacy of a MAR project. Another key risk to manage for MAR projects is to ensure that the source of recharge water is of high quality and does not create issues for any of the beneficiaries including potable water and the ecosystems that depend on groundwater. With thousands of projects around the world, there is a considerable amount of information and expertise in properly developing and implementing MAR projects, and most importantly manage the potential risks associated with the proactive recharge of water into aquifers.

**National MAR Trials in New Zealand**

Bob and Clare have been involved in developing two national MAR trial projects, one located on the Canterbury Plains (Hinds Catchment) and in one near Gisborne. These two projects represent New Zealand’s first applications of MAR integrated with more traditional irrigation infrastructure to address catchment specific groundwater storage and farm-related water quality issues. More recently, a MAR trial in the Oreti Catchment, Southland is being considered.
Canterbury

On the Canterbury Plains, the Hinds project is aimed at improving long term storage (quantity) for both irrigation supplies and environmental flows and improving the overall quality of the groundwater. The Hinds / Hekeao catchment lies between the Ashburton River to the north and the Rangitata River to the south. It has degraded groundwater quality with areas of higher nitrate concentration associated with intensive land use linked to agricultural leaching. In addition, the catchment has long-term declining groundwater levels and coastal spring-fed drain flows. These are attributed to a combination of irrigators moving to more efficient irrigation systems, a reduction in the amount of unlined stockwater races, increases in groundwater pumping and changing weather patterns. The purposeful replenishment of the aquifer is intended to help the natural recharge processes (rainfall and river recharge) to manage the overall water balance for the catchment and improve groundwater quality.

The MAR Pilot Trial site is in the Valetta groundwater allocation zone area near Lagmhor. High quality water from the Rangitata River is directed to the site for recharge. The site was selected based on a variety of factors including depth to the water table, soil conditions and proximity to both coastal spring-fed drains and long-term, high nitrate concentrations in the local groundwater.

The Pilot Trial includes a 900-metre-long water race that delivers water to the main site consisting of a forebay and a main recharge basin covering 0.9 ha (Figure 1 and 2). The forebay is designed to capture any sediments carried in the source water.

Figure 1: Lagmhor MAR Trial site, Hinds, Canterbury.
Figure 2: Inlet to Lagmhor MAR Trial site.

The trial has clearly resulted in dramatic groundwater quality improvements in terms of nitrate concentration (Figure 3). The Hinds/Hekeao MAR Governance Group representing the community is now looking to develop a catchment-wide Groundwater Replenishment Scheme which will seek to integrate MAR into the existing irrigation water conveyance and on-farm storage scheme.
Figure 3. Monitoring results from a monitoring bore approximately 1 km from the Hinds Trial site. Hinds MAR Trial Year 1 results show increasing groundwater levels and decreasing nutrient (nitrate – nitrogen) concentrations.

Gisborne

On the Poverty Bay flats, a prime horticultural region near Gisborne, regional planning efforts are seeking to reduce over allocation of water from the Makauri Aquifer, which represents the primary groundwater resource in the region. Local irrigators partnering with a community trust, local iwi and technical staff from Gisborne District Council have designed and implemented a MAR pilot trial to seek an innovative approach to improve subsurface storage.

The pilot site uses another MAR tool, direct injection, due to the nature of the target aquifer for recharge. The project consists on an injection bore drilled down 70 m into the confined Makauri Aquifer (Figure 4). The site takes water from the Waipaoa River during high flows through a gallery located beneath the river gravels and can inject approximately 17 L/s. The trial will continue for another 2 years of monitoring under the guidance of Gisborne District Council.

Successful trial results have motivated a local growers group to establish Makauri Aquifer Recharge Limited (MAR Ltd), which represents a large group of growers seeking to develop a groundwater replenishment scheme as an alternative to claw back.

Figure 4: Makauri Aquifer MAR trial site, Gisborne.
**Southland**

There is recent interest in developing a MAR pilot trial to explore the viability of using the local confined aquifer system in the Oreti Basin for water storage. A successful trial site could subsequently be converted into a long-term operational MAR site and incorporated into a groundwater replenishment scheme for the Oreti Basin.

**Summary**

The current MAR trials in New Zealand, are helping to provide a new approach for the management of water quantity and quality. Based on international best practices and lessons learnt from decades of use overseas, the concept of integrating surface supplies and delivery with a more proactive approach to replenishing groundwater is providing a new way to approach water resources management. A well-managed and maintained aquifer can work to provide benefits for not only irrigation but for the environmental and cultural issues that are becoming a more prevalent issue for the primary sector. Developing solutions that work to utilise natural processes and moves away from roller-coaster ride of unmanaged supplies will surely help us prepare for the future and ensure that production is maintained and enhanced for future generations.

**References**


Can Nutrient Limits and Greenhouse Gas Reductions be achieved while 
Operating Profitable Farm Systems

Dawn Dalley¹, Robyn Dynes², Ina Pinxterhuis¹, David Chapman¹, Nick Tait¹, Ross Monaghan²

¹DairyNZ Ltd, Lincoln; ²AgResearch

Summary

- Environmental regulation requires farmers to reduce losses of nutrients (nitrogen (N), phosphorus (P), sediment and faecal micro-organisms) from their farms to water
- Impending greenhouse gas (GHG) emissions targets will require a reduction in losses to air
- N surplus (kg N/ha; N inputs – N outputs) and N use efficiency (NUE %; N outputs/N inputs) are important metrics for understanding the opportunity to reduce N loss to water and air
- Farmers must know the specifics of the nutrient limits they are targeting. Different targets will require different strategies.
- The main options available for farmers to reduce N surplus and therefore nitrate (NO₃) and nitrous oxide (N₂O) losses and/or increase NUE are:
  - Improve the efficiency of converting N inputs to product – higher genetic merit cows, reduced replacement rates, better timing of N fertiliser applications, better pasture and feed utilisation,
  - Reduce N inputs – amount of N fertiliser; amount and/or N content of supplementary feed, especially in the autumn,
  - Reduce the number of milking cows in the autumn,
  - Capture a proportion of the surplus N excreted by the cows and redistribute this at times and in places that increases N utilisation – off-paddock facilities for autumn and/or winter use; improved effluent management.
- To reduce P, sediment, and faecal micro-organism loss, focus on practices that:
  - reduce the risk of soil damage (i.e. pugging) – duration-controlled grazing, off paddock wintering, strategic grazing of critical source areas,
  - minimise the amount of bare soil (especially during periods of high rainfall) – use of catch crops, not overgrazing pastures in autumn, winter, or early spring,
  - provide physical barriers (bunds, wetlands), or vegetation changes (riparian buffer strips, long grass) that slow water flow or trap sediment.
- Reducing methane (CH₄) emissions is more challenging but options include:
  - Reducing feed inputs and adjusting stocking rates to match supply and demand,
  - Reducing replacement rates,
  - Alternative feed sources – forage rape, fodder beet.
Background

The roll-out of environmental regulations across New Zealand means farmers are increasingly required to operate their businesses in a manner that constrains nitrogen (N) leaching, phosphorus (P), sediment and faecal micro-organism losses and reduces greenhouse gas (GHG) emissions. Meanwhile, they are also continually striving to increase the productivity of their farms to maintain financial viability. The question then arises – Are these objectives mutually exclusive, or are there farm systems and practices that retain high profitability and low emissions?

Dairy farms primarily emit two GHGs: (1) CH₄ from enteric fermentation in the rumen, and (2) N₂O, arising mainly from denitrification of urinary N in the soil and nitrogen fertiliser application. Agriculture is responsible for about 48% of total GHG emissions in New Zealand but contributions to national emissions of methane (CH₄) are 86% and nitrous oxide (N₂O) 95% (Ministry for the Environment, 2017). From 1990 to 2015, total enteric fermentation emissions from dairy cattle have increased 130%. Total N₂O emissions increased 51% over the same period (Ministry for the Environment, 2017). A 6-fold increase in the application of synthetic nitrogen fertiliser since 1990, increased supplementary feed inputs and an 88% increase in the size of the national dairy herd over the same period have been the main drivers for this change in emissions (Ministry for the Environment, 2017).

The National Policy Statement for Fresh Water Management’ (NPS-FM) directs Regional Councils to set standards and limits for freshwater quality (MOE, 2014). The main nutrients of concern for water quality are ionic forms of N and in some instances P, plus other contaminants e.g. faecal coliforms and sediment. Nitrogen is more difficult to manage as it moves freely through the soil into water, whereas P usually stays bound to particles within the soil and mainly enters waterways through surface runoff and erosion.

Regional councils throughout New Zealand have taken different approaches and are working to different timelines to address the issue of setting nutrient loss limits for their regions (https://www.dairynz.co.nz/environment/in-your-region/).

In Canterbury, local Zone Committees are working with Environment Canterbury (ECan) in the limit-setting process, with some catchments e.g. Selwyn/Te Waihora and Hinds already having operative plans (https://www.dairynz.co.nz/environment/in-your-region/canterbury-environmental-rules/). Under Canterbury’s Land and Water Regional Plan, farmers must operate at good management practice (GMP) and most will need to prepare a farm environment plan and then obtain a new resource consent.

Otago’s Plan Change 6A (water quality) is the operative plan for the Otago region and includes rules for controlling leaching and runoff of contaminants and sediment from rural properties into waterways and drains (non-point source) (https://www.dairynz.co.nz/environment/in-your-region/otago-environmental-policy/). From 2020, further rules will apply to N loss limits and discharge thresholds.
In Southland the Southland Water and Land Plan provides the regulatory framework for the limit setting process. In April 2018 a ‘decisions’ version of the plan was notified (http://www.es.govt.nz/document-library/plans-policies-and-strategies/regional-plans/proposed-southland-water-and-land-plan/Pages/default.aspx). This is an interim step prior to the full limit setting process, which is due for completion by 2021.

Developing production systems that can maintain or increase profitability, while reducing impacts on receiving environments, including water and air, has been the focus of a range of research projects and modelling studies over the last 8 years (Beukes et al. 2017; Burggraaf et al 2011; Chapman et al. 2017; Clark et al. 2007; Pinxterhuis et al. 2017; Roche et al. 2016; Shephard et al. 2017; Vibart et al. 2015; Vogeler et al. 2013). The results of these studies will form the basis of this paper, with the primary focus on nitrate leaching and greenhouse gases.

Maximising the efficiency of the N cycle and minimising losses of N to air (GHG) and water (nitrates) must remain a key focus for farmers and scientists. Dairy farmers have harnessed the production benefits N fertiliser has delivered for pastoral agriculture; however, along with the gains in production and efficiency, increased use of N fertiliser and imported supplements has led to greater rates of N leaching and gaseous N losses. Nitrogen performance indicators can evaluate N use outcomes for optimum production while minimising the risk of environmental N losses. The metrics that are most relevant to managing environmental N emissions are:

1. Nitrogen use efficiency (NUE - %) i.e. the ratio of N exported from the farm per unit N inputs
2. Farm gate N surplus (kg N/ha/year) i.e. the difference between N inputs and N outputs which will be driven in part by the timing of N inputs

The relationship between NUE and the farm gate N surplus as defined above, and N output (in milk) is shown in the Figure 1 below. The three diagonal lines represent 50% NUE, 33% and 25% NUE. For example, when N output is 100 kg N/ha (on the left-hand axis), and N surplus is also 100 kg N/ha (on the horizontal axis), then N input must equal 200 kg N/ha (100 in output, 100 in surplus), and the NUE = 100 kg N output divided by 200 N input = 50%.
It is important to note that a high NUE does not necessarily lead to a low N surplus and therefore low risk of N loss. For example, 33% NUE (which is a relatively high figure) can still be associated with 400 kg N/ha surplus (at the very top right corner of Figure 1) even though milk production (N output) is also high. The whole farm NUE can be a valuable indicator for optimising fertiliser and feed use and minimising N loss but is not as valuable for setting targets to reduce the environmental impact of N use. Thus, whole-farm N surplus appears to be a more useful indicator because there is a strong relationship between N surplus and N leaching risk, as discussed further below. Timing of N input is an important contributing factor to the N surplus. Strategic use of N fertiliser to provide pasture at key times, particularly for spring pasture growth will contribute to reduced N losses to water and air. Using N fertiliser for autumn pasture growth that allows more cows to be milked longer will increase urinary N deposition and therefore the risk of N leaching.

We have used the N cycle (including GHG) as the basis for exploring mitigation options to reduce nutrient loss to water and air while maintaining profitable farm systems (Figure 2).
Implementing farm system changes to reduce nutrient loss is complicated. Points to consider include;

- What are my baseline nutrient losses?
- What options are suitable for my business and environmental goals?
- Will changes meet both current and future nutrient loss targets and deliver improved water quality for my farm, catchment and region?
- Are changes future-proofed for new nutrient targets (e.g. GHG)
- What are the risks to both financial viability and reaching required targets?
- What additional costs, complexity and unintended consequences are likely?

Poor understanding and over-simplification of changes can put both the achievement of reduced nutrient loss and the financial viability of the dairy farm business at risk. The options available to individual farmers must be assessed against overall farm performance and efficiency and tailored to meet the goals of continued business viability and improved water quality for their farm and region.

It is important that farmers have knowledge of the specifics of the nutrient limits they are targeting. Different targets will require different strategies, and capital investment or farm system change may not be consistent with meeting a limit in an individual catchment.
Capital investment or farm system change can place a business at significant risk, especially if the resulting system does not meet required long term regional or catchment targets. Farmers in regions and catchments where limits are still being negotiated need to understand their current nutrient budget and if they are contemplating system changes, including investment in off-paddock facilities, a full system analysis must be completed to minimise business risk.

**Strategies for reducing N loss**

**Farm gate nitrogen surplus**

Irrespective of soil type, there is a positive relationship between farm gate N surplus and gaseous and water losses of nitrogen from farm systems. For example, in the ‘1.75 t milksolids’ systems experiment where nitrate leaching was measured directly, leaching increased by about 3.5 kg N/ha per year for every 10 kg increase in the N surplus per hectare (Ledgard et al. 1999). At the same time, N output in milk increased by only 1.4 kg N/ha (about 20 kg milksolids/ha) for every 10 kg increase in N surplus (Figure 3). Thus, as systems intensified, they became less efficient at converting all the N imported in fertiliser and feed into milk, and the increasing surplus of N input over N output was associated with large increases in N leaching.

![Figure 3](image-url)

**Figure 3.** Relationship between whole-farm N surplus and N output in milk (triangles and green/grey line) and N leaching (squares and blue/black line) from the 1.75 t milksolids trial. Data are from each of three years in four systems. From Ledgard et al (1999). Systems ranged from zero N fertiliser and feed imported to 400 kg N fertiliser plus 5900 kg DM imported feed per hectare.

Overseer\textsuperscript{®} calculations for nearly 400 dairy farms analysed in the DairyNZ Baseline project for 2015/16 year predicted an increase of 2 kg N leached per hectare per 10 kg increase in the N surplus (DairyNZ economics team, unpublished data). This does not mean every farm can reduce leaching by 2 kg N/ha by applying management practices that lower the N surplus by 10 kg/ha because there...
is a lot of variation among farms. But it is an indication of the gains that can be made using the farm-
gate N surplus as a guide (Beukes et al. 2013, 2017). No other management factors analysed in the
Baseline project (e.g. stocking rate, total feed eaten) showed a close relationship with N leaching –
apart from the amount of N fertiliser applied per hectare, which is a major driver of N surplus.

From a farm management perspective, dairy farm managers have some control over NUE and
the farm gate N surplus. The main options available to farmers reduce N surplus and/or increase
NUE are summarised below:

1. Improve the efficiency of converting N inputs to product – higher genetic merit cows, reduced
replacement rates, better timing of N fertiliser applications, better pasture and feed utilisation
2. Reduce N inputs – amount of N fertiliser; amount and/or N content of supplementary feed
3. Reduce the number of milking cows in autumn
4. Capture a proportion of the surplus N excreted by the cows and redistribute this at times and
in places that increases N utilisation – off-paddock facilities for autumn or winter use;
improved effluent management

The first option increases NUE. In the diagram below (Figure 4), a ‘notional’ target zone of <
200 kg N/ha surplus and > 100 kg N/ha output (approximately 1450 kg MS/ha) is shown (in the
green/grey triangle, bounded at the top by the 50% NUE line because 50% NUE is the maximum that
could be expected in grazing systems), and a notional farm is shown by the blue/grey dot. The
notional farm is operating at about 28% NUE.

Focussing on the practices listed in Option 1 above without reducing N inputs could move the
farm in the direction of arrow 1 in Figure 4: up to 33% NUE, higher production, but no closer to the
target zone. This is a win for production but is neutral for the environment (no substantial reduction in
N loss).

Focussing on the practices in Option 2 above without any increase in efficiency with which N
inputs are used for production would take the farm in the direction of arrow 2 in Figure 4: to a lower N
surplus (good for the environmental emissions), but with lower production (< 100 kg N/ha) and
therefore less farm income. This is a win for the environment but a loss for production, and probably
for profit.

It is only through a combination of Options 1 and 2 that the notional ‘target zone’ can be
reached. The ideal result would be no loss in production but a large reduction in the N surplus (arrow
3 in Figure 4). This is a big win for the environment. It is neutral for production but should be a win for
profit since it is associated with a big increase in NUE up to 41% (implying lower costs per unit
production).

In practice, such a big increase in NUE (from 28% to > 40%) is hard to achieve, and the
trajectory may be more like arrow 4 in Figure 4, where some loss in production is incurred. However,
this production (income) drop may be counterbalanced by lower costs of production associated with
less imported feed and N fertiliser with a concurrent increase in efficiency of conversion of the new levels of feed and fertiliser to milk. In this case, NUE increases from 28% to > 33% but the first move was to reduce inputs (reduce the N surplus) then re-optimise the system (increase NUE). In all, the result is a large win for the environment, a loss in production (about 15% in the hypothetical example shown, which is not trivial), but a potentially neutral result for, or slight increase in, profit.

**Figure 4.** Impact of management changes on production (N output kg/ha) and environmental impact (N surplus kg/ha) with the associated change in nitrogen use efficiency (NUE). Arrow 1 = increase in NUE, small reduction in surplus; arrow 2 = reduction in surplus, no increase in NUE; arrows 3 and 4 = increase in NUE and reduction in N surplus.

Roche et al. 2016 concluded that nitrate leached/ha tended to decline with increasing stocking rate in a seasonal, spring-calving, pasture-based dairy production system that imported less than 5% of feed from off-farm and that did not increase N fertiliser inputs with increasing stocking rate. This occurred despite a linear increase in pasture harvest and in milk output/ha. The key driver for this result was a **decrease in the average days in milk (DIM)/cow as stocking rate increased** (Option 3 above). Culling and drying off strategies, NOT the importation of supplementary feed, were used to reduce feed demand in autumn. The reduction in DIM/cow resulted in lower intake of crude protein during autumn, reducing the urinary excretion of N preceding the most sensitive period for leaching of urine N. The authors hypothesised that at higher stocking rates there was increased spreading of urinary N (assuming more cows = more urine patches), greater plant recovery of N, and lower leaching from the urine patches.

Importantly, the options and pathways for change will differ for each farm because the combination of a farms’ current position (equivalent to the blue/grey dot in the Figure 4) and the relevant regional environmental limits (equivalent to the green/grey triangle in Figure 4) will be unique.
for each business. Fundamentally, the issue for each farm is: how far is the dot from the triangle? This is the first thing to ascertain, via for example Overseer® files or Fonterra farm N calculations, combined with an understanding of the percentage reductions in N leaching required by the Regional Council. Management responses can then be worked-through to find possible solutions. A full farm system-level analysis of any change must be undertaken to determine its effect on productivity and environmental outcomes.

Farm management practices and mitigation options to reduce N loss via water and air along with a qualitative assessment of the costs, ease of implementation, changes to feed supply and potential environmental impact are summarised in Table 1.

**Strategies for reducing P and sediment loss**

The risk of P and sediment loss increase in regions with heavier soil types and undulating topography, however losses can still occur from ‘flat’ land with ephemeral streams and marginal slope (https://www.dairynz.co.nz/environment/land-management/critical-source-areas/ ). Practices that reduce the risk of soil damage (i.e. pugging; Monaghan et al. 2017), minimise the amount of bare soil (especially during periods of high rainfall) and provide physical barriers (bunds, wetlands), or vegetation changes (riparian buffer strips, long grass) that slow water flow or trap sediment will reduce the risk of P and sediment losses to waterways. Farm management practices and mitigation options to reduce P and sediment losses to water along with the costs, ease of implementation and potential environmental impact are summarised in Table 2.
# Table 1: Mitigation options for nitrate leaching, methane, and nitrous oxide emissions with an estimate of likely cost of implementation, ongoing costs, ease of implementation, changes to feed supply and size of the likely benefit

<table>
<thead>
<tr>
<th>Colour indicates estimated size or direction of impact i.e. % change or positive, neutral or negative impact for GHG</th>
<th>Upfront cost</th>
<th>Ongoing impact on Operating Profit</th>
<th>Ease of implementation</th>
<th>Changes to feed supply</th>
<th>Impact on N leaching</th>
<th>Impact on methane emissions</th>
<th>Impact on nitrous oxide emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>None to low</td>
<td>No change or positive</td>
<td>Easy</td>
<td>Small</td>
<td>&gt;25%</td>
<td>positive effect</td>
<td>positive effect</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>Minor reduction</td>
<td>Do-able</td>
<td>Medium</td>
<td>10-25%</td>
<td>Neutral</td>
<td>Neutral</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>Significant reduction</td>
<td>Difficult</td>
<td>Large</td>
<td>&lt;10%</td>
<td>Negative effect</td>
<td>Negative effect</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

### Reducing N Surplus

<table>
<thead>
<tr>
<th>Less N fertiliser (base &gt;200 kg N/ha/year)</th>
<th>Cost saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less N fertiliser (base &lt;200 kg N/ha/year)</td>
<td>Cost saving</td>
</tr>
<tr>
<td>Reduce supplementary feed inputs (kg DM/cow)</td>
<td>Cost saving unless there is stranded capital ie feedpad</td>
</tr>
<tr>
<td>Change to low N supplements/improve feed quality</td>
<td>May require off paddock infrastructure or in shed feeding depending on change from and to</td>
</tr>
<tr>
<td>Use alternative pasture species or crops to decrease the total N in the diet</td>
<td>Depends on cost differential between supplements</td>
</tr>
<tr>
<td>Early culling in autumn</td>
<td>Depends on cost differential to the feed it replaces</td>
</tr>
</tbody>
</table>

Colour indicates estimated size or direction of impact. For GHG, the colour indicates estimated size or direction of impact i.e. % change or positive, neutral or negative impact for GHG.
<table>
<thead>
<tr>
<th>Improved efficiency of converting N to product</th>
<th>Upfront cost</th>
<th>Ongoing impact on Operating Profit</th>
<th>Ease of implementation</th>
<th>Changes to feed supply</th>
<th>Impact on N leaching</th>
<th>Impact on methane emissions</th>
<th>Impact on nitrous oxide emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher genetic merit cows</td>
<td>None to low</td>
<td>No change or positive</td>
<td>Easy</td>
<td>Small</td>
<td>&gt;25%</td>
<td>positive effect</td>
<td>positive effect</td>
</tr>
<tr>
<td>Low N sires</td>
<td>Medium</td>
<td>Minor reduction</td>
<td>Do-able</td>
<td>Medium</td>
<td>10-25%</td>
<td>Neutral</td>
<td>Neutral</td>
</tr>
<tr>
<td>Reduced replacement rate</td>
<td>High</td>
<td>Significant reduction</td>
<td>Difficult</td>
<td>Large</td>
<td>&lt;10%</td>
<td>Negative effect</td>
<td>Negative effect</td>
</tr>
<tr>
<td>Winter active pasture species eg Italian ryegrass</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>Catch Crops following autumn or winter grazing of crop</td>
<td>Direct cost of establishment</td>
<td>Costs associated with pasture establishment</td>
<td>May change seasonality of feed supply</td>
<td>Depends on scale of use</td>
<td>If it reduces total N use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detailed irrigation scheduling and application relative to soil moisture</td>
<td>Restricted N use in autumn could change pasture supply</td>
<td>Depends on soil type, climate and whether already at GMP</td>
<td>Less volatilisation to ammonia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Better timing of N fertiliser applications</td>
<td>Cost of providing soil moisture sensors</td>
<td>Restricted N use in autumn could change pasture supply</td>
<td>Depends on soil type, climate and whether already at GMP</td>
<td>Less volatilisation to ammonia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urease inhibitors</td>
<td>None to low</td>
<td>No change or positive</td>
<td>Easy</td>
<td>Small</td>
<td>&gt;25%</td>
<td>positive effect</td>
<td>positive effect</td>
</tr>
<tr>
<td>Capturing surplus N excreted and redistributing</td>
<td>Requires an area that captures nutrients</td>
<td>Ongoing costs dependent on infrastructure type</td>
<td>May allow pastures to be protected in autumn</td>
<td>High risk of pollution swapping</td>
<td>Improved application of manure &amp; effluent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Removing cows from pasture in autumn</td>
<td>None to low</td>
<td>No change or positive</td>
<td>Easy</td>
<td>Small</td>
<td>&gt;25%</td>
<td>positive effect</td>
<td>positive effect</td>
</tr>
<tr>
<td>Off paddock wintering</td>
<td>Medium</td>
<td>Minor reduction</td>
<td>Do-able</td>
<td>Medium</td>
<td>10-25%</td>
<td>Neutral</td>
<td>Neutral</td>
</tr>
<tr>
<td>Better effluent &amp; manure management</td>
<td>High</td>
<td>Significant reduction</td>
<td>Difficult</td>
<td>Large</td>
<td>&lt;10%</td>
<td>Negative effect</td>
<td>Negative effect</td>
</tr>
<tr>
<td>Better effluent storage</td>
<td>None to low</td>
<td>No change or positive</td>
<td>Easy</td>
<td>Small</td>
<td>&gt;25%</td>
<td>positive effect</td>
<td>positive effect</td>
</tr>
</tbody>
</table>

Colour indicates estimated size or direction of impact i.e. % change or positive, neutral or negative impact for GHG.
Table 2. Mitigation options for phosphorus (P) and sediment loss with an estimate of likely cost, on-going costs, ease of implementation and size of the likely benefit

<table>
<thead>
<tr>
<th>Colour indicates estimated size of impact i.e.% change</th>
<th>Upfront cost</th>
<th>Ongoing impact on Operating Profit</th>
<th>Ease of implementation</th>
<th>Impact on P and sediment loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>None to low</td>
<td>None to low</td>
<td>No change or positive</td>
<td>Easy</td>
<td>&gt;50%</td>
</tr>
<tr>
<td>Medium</td>
<td>Medium</td>
<td>Minor reduction</td>
<td>Do-able</td>
<td>20-50%</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
<td>Significant reduction</td>
<td>Difficult</td>
<td>&lt;20%</td>
</tr>
<tr>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

### Sediment & P

- **Permanently exclude stock from all CSA's**: Depends on scale
- **Temporarily exclude stock from CSA's during wet months**: Depends on scale
- **Redirect new tiles or moles into wetlands, swales, riparian margins**: Depends on scale, Landscape dependent
- **Regular cuts along laneways to divert runoff away from waterways**: Depends on scale, Farm dependent
- **Bunds on bridges and crossings**: High point source but small at farm scale
- **Bunds on laneways adjacent to waterways and drains**: Low for new races, could be expensive to retrofit, Landscape dependent, Low for new races, could be difficult to retrofit
- **Increase riparian buffer strips at high risk sites (steep slopes, low lying land, ephemeral streams)**: Depends on scale, High point source but farm/catchment effect depends on scale
- **Plant poplar poles on steeper, erosion prone land**: Depends on scale
- **Fence off seepage wetlands that occur at breaks in slope**: Depends on slope
- **Select crop paddocks furthest away from waterways**: Depends on slope
- **Use lower stocking rate, different crop or lighter stock class on more sensitive soils**: Depends on slope
- **P only**
  - **Manage Olsen-P within the optimum range**: Depends on slope
  - **Good practice effluent storage (no seepage/transfer of liquid or dung)**: Point source
  - **Manage timing and rate of effluent application to minimise P runoff**: Point source
  - **Ensure at least 1 m of ungrazed buffer around all drains**: Point source
  - **Avoid pugging and associated runoff**: Point source
Pastoral 21 N loss, greenhouse gas emissions and operating profit

The P21 project investigated alternative farm systems targeted at reducing N leaching by at least 30% while maintaining or increasing operating profit. Farm systems comparisons were undertaken in the Waikato, Canterbury, and South Otago with the key features of each comparison summarised in Table 3. The system changes included (i) fewer, higher producing cows, (ii) reduced N fertiliser inputs, (iii) reduced herd replacement rate, (iv) replacing pasture silage with high energy/low N feed and (v) using off-paddock facilities to reduce the time cows spent on pasture or forage crops.

The alternative systems in all regions reported significant reductions in nitrate leaching (Table 3). Except for the higher input ‘alternative’ system in Canterbury, all the ‘alternative’ systems also had lower GHG emissions (kg CO$_2$e/ha) than the ‘current’ system (van der Weerden et al., in press). Methane represented 79 to 83% of the total GHG footprint across all systems, with enteric CH$_4$ from lactating cows grazing pasture being the major source. Excreta deposition onto paddocks was the largest source of nitrous oxide (N$_2$O) emissions, representing 7-12% of the total GHG footprint for all systems.

The reduced feed supplies and associated lower stocking rates of the alternative systems were the key drivers of lower total GHG emissions in all three regions. The main effects of these alternative system attributes were reduced total enteric CH$_4$ emissions and reduced nitrogen intake, which lowered N excretion and, thus, N$_2$O losses. While the use of off-paddock facilities reduced N leaching, increased CH$_4$ emissions during manure storage prevented the dual environmental benefit of reduced leaching and GHG emissions. The cost vs environmental benefit of off-paddock facilities must also be considered during the decision-making process.

From an economic perspective the difference between the systems was dependent on season, feed price, milk price and costs associated with off-paddock facilities. In Canterbury the lower input ‘alternative’ system had a $100/ha higher operating profit at a $6.30 milk payout. As milk payout declined the difference between the two systems increased such that at a $4.40/kg MS payout there was an estimated $1129 profit advantage to the lower input system. Imported feed costs and per cow associated costs (breeding, wintering etc) were higher for the higher input system. Milk production revenue did not cover these increased costs when milk price dropped below $6.30/kg MS.

In the Waikato systems the alternative farm system had greater costs (associated with off-paddock facilities) than the current system and although per cow milksolids production was increased by 75 kg on the alternative system, there was a decrease in the annual per hectare production of 50 kg. As a result, the alternative system yielded on average $279/yr less profit than the current system. Lower cost options of off-paddock infrastructure would help improve the profitability of the alternative system as depreciation was the biggest cost difference between the systems. Genetic progress that allowed cows to better utilise pasture when the
pasture allowance is increased, thus maintaining production would also have a positive impact on profit in the alternative system but may reduce the environmental benefits.

In the South Otago systems, average operating profit only differed by less than $150/ha between the 3 systems, with the system implementing duration-controlled grazing and off-paddock wintering (DCG) having the higher operating profit. Cost of feed, including direct feed costs, replacement rearing, off-paddock facility maintenance, re-grassing and cropping and nitrogen fertiliser costs defined most of the small variation in costs between the systems. Freight to transport cows to wintering was a significant cost for cows in the control and OPT Feeding system. When financial performance was assessed on return on capital the DCG system had a lower return due to the high costs of the infrastructure, an extra tractor and the requirement for additional effluent storage and manure management.

Conclusion

A win-win profitable farming system with a lower environmental footprint can be done. However, implementing farm system changes to reduce nutrient losses to air and water, while continuing to operate profitable farm systems, is complicated and can bring new levels of complexity, require different feed and fertiliser use strategies, or require capital investment. The relative profitability will be sensitive to milk payout and input costs.

A silver bullet, or even one mitigation or farm management system that will deliver all the necessary reductions for all contaminants in all catchments is highly unlikely, however, recent research has identified several options that when combined will go a long way to achieving desired outcomes. Identifying practices where potential pollution swapping may occur should be the focus of future research, especially considering potential regulation for greenhouse gas emissions.

For nitrogen, focusing on the nitrogen cycle and reducing the farm N surplus will have a positive impact on N losses to water and air. Practices that reduce the risk of soil damage i.e. pugging, minimise bare soil, especially during periods of high rainfall and provide physical barriers (bunds, wetlands) or vegetation changes (riparian buffer strips, long grass) that slow water flow or trap sediment will reduce the risk of P and sediment losses. Current methane reduction options centre on reducing feed inputs and adjusting stocking rates and reducing replacement rates.

The options available to individual farmers must be assessed against overall farm performance and efficiency and tailored to meet the goals of continued business viability and improved water quality for their farm and region.

References

damage in two dairying regions on New Zealand. New Zealand Journal of Agricultural Research 56: 224-238.


Table 3. Key management features of ‘current’ and ‘alternative’ systems, and measured or estimated N leaching losses, in Waikato, Canterbury and South Otago.

<table>
<thead>
<tr>
<th></th>
<th>Waikato</th>
<th>Canterbury</th>
<th></th>
<th>Otago</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current</td>
<td>Alternative</td>
<td>Higher input</td>
<td>Lower input</td>
<td>Current</td>
<td>OPT</td>
<td>DCG</td>
<td></td>
</tr>
<tr>
<td>Stocking rate (cows/ha)</td>
<td>3.2</td>
<td>2.6</td>
<td>5.0</td>
<td>3.5</td>
<td>3.0</td>
<td>2.8</td>
<td>2.8</td>
<td></td>
</tr>
<tr>
<td>Cow genetic merit (BW#)</td>
<td>129</td>
<td>199</td>
<td>133</td>
<td>140</td>
<td>109</td>
<td>105</td>
<td>104</td>
<td></td>
</tr>
<tr>
<td>N fertiliser (kg N/ha/yr)</td>
<td>137</td>
<td>52</td>
<td>311</td>
<td>158</td>
<td>109</td>
<td>42</td>
<td>73</td>
<td></td>
</tr>
<tr>
<td>Replacement rate (%)</td>
<td>22</td>
<td>18</td>
<td>23</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High energy/low N feed</td>
<td>0</td>
<td>0.24 (Grain t DM/cow/yr)</td>
<td>0.5 (Grain t DM/cow/yr)</td>
<td>40% diverse pasture</td>
<td>15% short rotation ryegrass/barley silage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stand-off/housing</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Milk solids production*</td>
<td>1,193</td>
<td>1,162</td>
<td>2,335</td>
<td>1,785</td>
<td>964</td>
<td>931</td>
<td>949</td>
<td></td>
</tr>
<tr>
<td>(kg MS/ha/yr)</td>
<td>369</td>
<td>444</td>
<td>467</td>
<td>510</td>
<td>329</td>
<td>333</td>
<td>334</td>
<td></td>
</tr>
<tr>
<td>Wintering</td>
<td>On platform</td>
<td>On platform</td>
<td>Fodder beet + Pasture silage</td>
<td>Kale + Oat silage</td>
<td>Kale</td>
<td>Kale</td>
<td>Pasture silage</td>
<td></td>
</tr>
<tr>
<td>Stocking rate (kg N/ha/yr)</td>
<td>34</td>
<td>15</td>
<td>200</td>
<td>307</td>
<td>200</td>
<td>200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total dairy system N loss</td>
<td>Estimated N leaching (kg N/ha/yr)</td>
<td>54</td>
<td>31</td>
<td>49</td>
<td>34</td>
<td>18</td>
<td>14</td>
<td>13</td>
</tr>
</tbody>
</table>
At Ravensdown, we believe there's always a way to improve; to innovate. Working with agri-science leaders, Ravensdown has developed a new tool to help you manage farm dairy effluent. We call it – ClearTech®.

To see how this emerging technology could help you reduce environmental impacts and optimise value from the land go to cleartech.co.nz or phone 0800 100 123.
Introduction

Infertility and the suboptimal lifetime productivity of dairy cows cost farmers more than $1.5 billion annually. We estimate that at least $550 million of this annual loss can be recovered through the development of innovative, practical solutions based on new science being funded by the Ministry of Business, Innovation, and Employment (MBIE) and NZ dairy farmers (DairyNZ Inc.), as well as leveraged funding from AgResearch. This is a large, multi-disciplinary research programme led by DairyNZ Ltd. and involves several collaborating organisations, including AbacusBio, Cognosco, NZ Animal Evaluation Ltd. (NZAEL), Massey University, University of Queensland, Monash University, VetEnt, VetSouth, and Victoria University Wellington.

In this paper, we describe the highlights from the first five years of this seven-year “Pillars of a New Dairy System” programme, and our plans to derive both genetic and managerial solutions that can be implemented by the dairy industry over the next few years.

Genetic solutions for improved cow survival and fertility

One strategy to increase the productive lifetime of dairy cows is to breed animals that are inherently healthier, more fertile, and last longer in the herd. New Zealand Animal Evaluation Ltd. (NZAEL), is an integral member of the “Pillars” programme. This alignment enables research findings that have the potential to provide genetic solutions to be delivered to farmers through incorporation into the national breeding objective (i.e. breeding worth; BW).

In the “Pillars” programme, we are focussing on two key areas for improved genetics: 1) developing a new Functional Survival breeding value (BV), to provide a better selection focus on survival related to general robustness and good health; and 2) increasing the accuracy of the Fertility BV, to enable accelerated genetic gain in fertility.

Improving functional survival genetics

The new **Functional Survival** BV has a targeted release date of February 2020. The aim is to replace the existing Residual Survival BV, with the benefit being accelerated genetic gain in cow longevity that is unrelated to fertility or milk production traits. The key changes are:

- The new functional survival trait accounts for cow survival from one lactation to the next, rather than cumulative survival. Culling reasons and genetic relationships between survival and other traits vary with cow age, and this new BV accounts for that variance.
• Lack of accurate fate coding for culled cows within the industry is problematic for calculating survival traits. Therefore, we have established validated rules to identify cows most likely culled due to infertility or low production when no fate record is available. This improvement allows the Functional Survival BV to focus on health- and robustness-related survival, and minimises “double-counting” with Fertility and Milk production BV in the national BW equation.

• Several Traits Other than Production (TOP) have been identified as indirect predictors of functional survival (Stachowicz et al., 2017). Body Condition Score and Milking Speed traits are predictors of early survival (i.e. during first and second lactations), and Udder Overall and Leg Straightness can predict late survival (i.e. from third lactation onwards). Using these TOP significantly increases the accuracy of genetic evaluation of functional survival.

Improving genetic fertility

Our goal is to accelerate the current 0.11 percentage unit gain per annum in genetic fertility to as much as 0.35 units. Gains can be made if the accuracy of measuring the Fertility BV is increased by using new measurable phenotypes that provide a stronger signal of genetic fertility than those currently used (e.g. re-calving within first 6 weeks).

To study the features driving genetic fertility, we have established a 500-cow Holstein-Friesian herd where approximately half the cows have a high Fertility BV (+5 units) and half have a low Fertility BV (-5 units). This herd was bred from specially selected, contract matings in 2014. Most other traits, such as live weight, milk production and percentage North American ancestry, are reasonably well balanced to minimise confounding. You can follow our progress with this herd while we validate the Fertility BV and discover novel measures for enhancing its accuracy at https://www.dairynz.co.nz/about-us/research/pillars-of-a-new-dairy-system/achieving-reproductive-targets/animal-model-research-herd/.

As maiden heifers, overall reproductive performance was superior in the high Fertility BV compared with the low Fertility BV heifers. The 6-week in-calf rate was 90% vs. 81% and the final non-pregnancy rate after 14 weeks of natural mating was 2% vs. 6%, respectively. A notable finding was the difference in time to puberty (Meier et al., 2017). High Fertility BV heifers attained puberty at a lighter live weight (271 vs. 296 kg; SD 4.3 kg; Figure 1), an earlier age (358 vs. 379 days; SD 6.0 days) and a lower proportion of estimated mature live weight (51 vs. 55%; SD 0.7%) compared with low Fertility BV heifers. A genetic estimation of these data indicated sufficient heritability for puberty (Price et al., 2017) to improve the accuracy of the Fertility BV. Accordingly, we are now conducting a “scale-up” study involving around 8,000 heifers of various breeds in commercial herds to obtain a more robust genetic assessment; a requirement before such changes can be incorporated into the Fertility BV and released to industry.
This high vs. low Fertility BV herd have recently completed their first mating period as lactating cows. Overall, reproductive performance was average to poor, a consequence perhaps of a tough climatic spring and the number of scientific manipulations that were performed on these cows. The differences between the lines, however, were remarkable. The 6-week in-calf rate was 34% greater in the high compared with the low Fertility BV cows (Table 1). The key driver for this marked difference was submission rate. Among high Fertility BV cows, 87 and 95% had been submitted for AI by three and six weeks following the mating start date, respectively; a marked contrast to a 48% 3-week submission rate and 54% 6-week submission rate for the low Fertility BV group. Milk progesterone profiling confirmed that these submission rate differences were a consequence of prolonged anoestrus in the low Fertility BV cows; an astonishing 44% of these animals had not even started cycling by the end of 6-week AB mating period.

**Figure 1.** Survival curves depicting high Fertility BV heifers attaining puberty at a 25 kg lighter liveweight than low Fertility BV heifers.
Table 1: Key reproductive characteristics of the high and low Fertility BV cows during the first lactation mating.

<table>
<thead>
<tr>
<th></th>
<th>High Fertility BV</th>
<th>Low Fertility BV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers</td>
<td>257</td>
<td>224</td>
</tr>
<tr>
<td>% calved by 3 weeks</td>
<td>76</td>
<td>71</td>
</tr>
<tr>
<td>% calved by 6 weeks</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>% calved by 9 weeks</td>
<td>94</td>
<td>96</td>
</tr>
<tr>
<td>3-week submission rate (%)</td>
<td>87</td>
<td>48</td>
</tr>
<tr>
<td>6-week submission rate (%)</td>
<td>95</td>
<td>54</td>
</tr>
<tr>
<td>3-week in-calf rate (%)</td>
<td>55</td>
<td>26</td>
</tr>
<tr>
<td>6-week in-calf rate (%)</td>
<td>67</td>
<td>33</td>
</tr>
<tr>
<td>First service conception rate (all matings, %)</td>
<td>56</td>
<td>42</td>
</tr>
<tr>
<td>First service conception rate (first 6 weeks only, %)</td>
<td>58</td>
<td>52</td>
</tr>
<tr>
<td>Final not-in-calf rate (12 weeks mating, %)</td>
<td>17</td>
<td>42</td>
</tr>
</tbody>
</table>

The results of this study indicate non-cycling is the major point of difference between high and low genetic merit for fertility, at least within this Holstein-Friesian population. As with the puberty trait, we are now planning to conduct a “scale-up” study to measure non-cycling in thousands of cows of various breeds within commercial herds identified as having very accurate records. The purpose will be to assess the value of recording and integrating this trait into the Fertility BV for accelerating gain in genetic fertility.

Managerial solutions for improved fertility and cow survival

For the cow, the riskiest period of succumbing to health-related disorders that threaten subsequent fertility, productivity, and survival in the herd is the transition period; defined as three weeks either side of calving. We are, therefore, focussing efforts on devising management solutions that alleviate the stresses that cows experience through the transition period. A schematic (Figure 2) depicts this rationale, linking the transition period to underpin success in several key areas that determine if a cow gets back in calf within the first six weeks of mating (i.e. 6-week in-calf rate).

The key areas we are focussing on are:

1. accelerating recovery of the postpartum uterus and improving its ability to support early embryonic survival;
2. accelerating recovery of oestrus cycles after calving, particularly those at risk of not cycling by the start of the mating period;
3. maximising the quality of the oocyte destined to establish pregnancy.
Prevalence of endometritis in the national herd

We have estimated the prevalence of uterine infection/inflammation (endometritis; Area 1, Figure 2) in 1,800 cows randomly selected from 100 herds in the North and South Islands (Burke and McDougall, 2017). Two diagnostic approaches were used to assess endometritis: purulent vaginal discharge (PVD) endometritis, based on the routinely used Metricheck score of 2 or more; and cytological (CYTO) endometritis, defined as more than 2% of cells in the uterus classified as polymorphonucleated (PMN, i.e. neutrophil cells indicating infection and inflammation). Examinations were performed about 30 days before the mating start date. The median prevalence of PVD-endometritis was 25%, indicating that a quarter of cows in a herd were affected with this type of reproductive tract disorder. Note that, in contrast to other studies, reproductive performance was not reduced until cows had a Metricheck score of 3 or more (first-service conception rate declined from 53% to 44%, respectively). About 7% of cows had PVD-endometritis with a Metricheck score of 3 or more. The median prevalence of CYTO-endometritis was 27%, while 10% of cows had both PVD and CYTO-endometritis. Notably, cows diagnosed with CYTO-endometritis had substantially poorer reproductive performance, across all key measures (Table 2).
Table 2. Reproductive performance of cows diagnosed with CYTO-endometritis (PMN% greater than 2) compared with those assessed as having a normal, uninflamed uterus (PMN% 2 or less) 30 days before the start of mating (adapted from Burke and McDougall, 2017)

<table>
<thead>
<tr>
<th>CYTO-endometritis</th>
<th>PMN%</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 or less</td>
<td>More than 2</td>
<td>P-value</td>
<td></td>
</tr>
<tr>
<td>No. cows</td>
<td>1318</td>
<td>488</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>% cows</td>
<td>73.0</td>
<td>27.0</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>First-service conception rate (%)</td>
<td>54.5</td>
<td>45.8</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>3-week submission rate (%)</td>
<td>89.3</td>
<td>83.7</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>In-calf by 3 weeks (%)</td>
<td>55.4</td>
<td>44.4</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>In-calf by 6 weeks (%)</td>
<td>76.4</td>
<td>67.5</td>
<td>&lt;0.001</td>
<td></td>
</tr>
</tbody>
</table>

Indications are, therefore, that a significant degree of reproductive failure can be attributed to a failure of the uterus to recover to a fully healthy state by the time that pregnancy must be re-established in a seasonal dairy system. In addition, there was substantial between-herd variation in the prevalence of endometritis, ranging from less than 1% to about 60% for either PVD- or CYTO-endometritis.

We believe that this herd variation probably relates to how well the cows are transitioned from late pregnancy through to the first few weeks of lactation. This is the period of highest risk for cows succumbing to health disorders that delay the recovery of the reproductive tract to a state that can support pregnancy. Since many of these disorders around calving are preventable, we believe that improved transition cow management offers the greatest opportunity for minimising endometritis through a managerial approach, particularly because CYTO-endometritis cannot be routinely diagnosed.

**Improving follicular environment and oocyte quality to increase conception rates**

Statistics compiled from InCalf Fertility Focus reports by LIC confirm that the average conception rate in NZ herds is 52%, which is 8% lower than required to achieve the industry target of 78% of cows in calf by 6 weeks following the mating start date. We have determined that almost 90% of inseminations result in a fertilised egg (oocyte), but a quarter of these embryos die soon afterwards resulting in only 66% of cows having a viable embryo 7 days after insemination (Berg et al., 2016). Embryo losses after the first week are smaller and gradual, with 55% of cows having viable pregnancies 10 weeks post-insemination.

The greater pregnancy failure rates during the first week of insemination leads us to believe that there are deficiencies in the competency of the oocyte to survive the early stages of embryonic development. Therefore, the health of the preovulatory follicle and its effect on oocyte quality (Area 2, Figure 2) may underpin conception rates. We know that oocytes and their surrounding cumulus cells undergo massive changes during the late maturation phase, and they are required to store nutrients to survive for four days before the embryonic genome is activated. Extensive *in vitro* studies have been conducted in novel culture media that is physiologically relevant to dairy cows, to identify the...
rate-limiting nutrients during this process. Since the nutrient composition of follicular fluid and circulating blood are very similar, we are seeking a practical on-farm solution whereby cows could be supplemented (through diet or parenterally) with these rate-limiting nutrients to improve the follicular environment and oocyte competency, leading to better conception rates. This potential solution needs much more research and it is unlikely that this work will be completed within the timeframe of this programme.

**Increasing premating cycling**

Non-cycling (Area 3, Figure 2) is perhaps the greatest contributor to infertility in our seasonal dairy system, and certainly featured as a key point-of-difference between the high and low fertility BV cows within the animal model herd. We tested the effect of an intramuscular injection of kisspeptin-agonist on accelerating reproductive recovery in anovulatory cows that are three to four weeks postpartum. Kisspeptin is a neuroendocrine peptide with a potent stimulatory action on gonadotrophin releasing hormone (GnRH) neurons in the hypothalamus. It has been used successfully to stimulate oestrous cycles in seasonally anoestrous ewes, as well as other mammalian species, but, until now, had never been tested in cattle.

Our work to date indicates that the kisspeptin-agonist is fully effective in inducing ovulation, provided a healthy, active follicle is present in the ovaries at the time of treatment. Further work is required to refine the protocol before kisspeptin-agonist could be developed as a tactical option for increasing pre-mating cycling rates in commercial herds.

**Improving transition metabolic and immune function**

Collectively, our analyses indicate that improving animal health during the first four weeks after calving is a major requirement to improve cow welfare, fertility, and longevity. The risk of on-farm death is significantly greater during the first month post-calving compared with other times of the year, particularly for older cows, and many culls originate from issues experienced around calving (Compton et al., 2016). We are looking at options for alleviating various problems that cows commonly experience during the transition period; problems that compromise their productivity and fertility (i.e. Areas 1, 2 and 3 in Figure 2). Hyperketonaemia, compromised immune function, and hypocalcaemia are the key conditions we have focussed on.

**Hyperketonaemia**: Data from previous NZ and international studies indicates that moderate hyperketonaemia, defined as blood concentrations of β-hydroxybutyrate ≥1.2 mmol/L, is associated with increased risk of uterine infections, lower reproductive performance, lower milk production, greater incidence of other metabolic diseases and mastitis in early lactation. Recent overseas studies in high-yielding housed cows indicate that treating moderately hyperketonaemic cows with monopropylene glycol (MPG), a glucose precursor drench, (in early lactation can improve reproductive performance, animal health, and milk production, and can reduce culling.

Results from a trial we conducted in Spring 2016 indicate that moderate hyperketonaemia is very common in pasture-based cows during early lactation; however, it is not necessarily associated with reduced animal performance. The pattern of hyperketonaemia after calving was highly variable...
between the three study herds, but peaked within the first 7-10 days postpartum. The relationships were strongly herd-specific, because in one herd moderate hyperketonaemia was associated with a lower 6-week in-calf rate but in the other two herds the opposite occurred. Accordingly, the effect of treatment of moderate hyperketonaemia with a MPG drench varied between the herds. MPG had no effect in two of the herds and, in fact, reduced reproductive performance in one herd. Given these varied outcomes, we do not recommend that MPG drench is used to treat cows with moderate hyperketonaemia unless there are additional signs of illness and/or cows are severely hyperketonaemic (β-hydroxybutyrate ≥3.0 mmol/L).

**Improving immune function:** The physiological transition from late gestation to early lactation is associated with altered functioning of the immune system and an inflammatory response. Although this is a natural process, common to all mammals, an inappropriate response can result in suboptimal immune function and/or an uncontrolled or chronic inflammatory state that is associated with increased susceptibility to health disorders post-calving.

We are investigating the immune restorative agent, peg-bovigrastim, as a strategy to boost immune cell (neutrophil) numbers and functionality around calving, thereby supporting the cow to fight off infections, as well as accelerate recovery of the postpartum uterus. Recent overseas studies indicate that cows treated with a two-dose regime of 15 mg peg-bovigrastim at approximately 7 days prior to anticipated calving date, and then within 24 h of calving, are less likely to suffer clinical mastitis or a retained placenta, and have a greater chance of cycling within 80 days of calving or being inseminated within 100 days of calving. We hypothesise that further refinements can be made to this protocol to enhance its practicality and value proposition in relation to our NZ farm systems.

In Spring 2017, we tested reduced dose rates and number of injections of peg-bovigrastim. A single injection on the day of calving provided a measurable boost in immune cell numbers over the first few days of lactation, indicating that it has promise as a practical on-farm method to treat cows when they come to the dairy for their post-calving check or first milking. Another study will be undertaken in Spring 2018 to determine if this modified protocol also improves immune cell function. Additional work will then be required to investigate if the modified protocol improves animal health and reproductive performance using large numbers of cows in commercial herds.

**Hypocalcaemia:** Hypocalcaemia (low blood calcium concentrations) is a common health disorder in dairy cows around calving in response to the sudden massive demand for calcium at the onset of lactation. Approximately 35% of cows are sub-clinically hypocalcaemic, whereas 5% exhibit clinical (i.e. milk fever) hypocalcaemia and 2% become “downer” cows. Hypocalcaemia is an animal welfare concern, limits animal productivity, suppresses cow immunity, and increases the risk of other metabolic and infectious disease.

Preconditioning cows to cope with the increased calcium demand can be achieved by feeding zeolite A (sodium aluminium silicate) prior to calving. Zeolite binds to cations, thus reducing dietary availability of minerals such as calcium, which has the effect of stimulating the cow to absorb more calcium from her diet and then readily mobilise body stores of calcium at calving.
Zeolite A is increasingly used in transition cow management in Europe, where a large amount of research has been undertaken in housed systems. In Spring 2016, we tested 2 weeks of pre-calving feeding of 500 g/cow/day of zeolite A in grazing cows and confirmed that it significantly reduces the risk of hypocalcaemia around calving under NZ conditions. Unexpectedly, we also noted that reproductive performance was improved. Although insufficient cows were involved in this study to be confident of a positive effect on fertility, a similar result has subsequently been demonstrated in a recent Cornell University study. Furthermore, reports in the literature indicate uterine involution and recovery may be accelerated by feeding zeolite before calving. Thus, sufficient evidence exists for us to further test this option as a strategy to improve cow health and reproductive performance, using larger numbers of cows.

However, although zeolite does show promise, it also results in a large and rapid decrease in blood phosphorus concentration and, to a lesser extent, blood magnesium concentration pre-calving. These effects indicate that feeding zeolite A pre-calving is unlikely to be compatible with diets that are deficient in phosphorus, such as high amounts of fodder beet. Careful management of magnesium supplementation pre- and post-calving is also required to prevent hypomagnesaemia, especially in herds with a borderline magnesium status. It is possible that a lower daily dose of zeolite and/or a reduced pre-calving feeding period may minimise the risk of hypophosphatemia and hypomagnesemia, but still provide adequate protection against hypocalcaemia. However, the consequences of a higher dose and/or longer pre-calving feeding period also need to be examined as it is highly likely that these will occur for some animals under typical springer herd/mob management scenarios in commercial herds. This work needs to be completed before we can undertake large scale-up studies on uterine health and reproductive performance.

**Summary and conclusions**

Losing cows to disease or pregnancy failure is a significant issue for dairy farmers. A large collaborative research programme, “Pillars of a New Dairy System”, is currently being undertaken to investigate new strategies to improve the fertility, health, and longevity of NZ dairy cows.

Since 2014, we have established a 500-cow research herd with low or high genetic merit for fertility; made up of heifer calves obtained in their first week of life from contract-mated dams. From their first lactation this season we take confidence that the Fertility BV works; it is probably targeting the big issue around non-cycling more than the chances of cows holding to AB. We have been able to trace this back to earlier traits; low fertility BV heifers take longer to achieve puberty. This and other early-life markers of genetic merit for fertility that will enable accelerated gain in genetic fertility are being developed.

Delayed recovery of the uterus after calving is also problematic. From our studies, about a quarter of cows in the herd are likely to have unresolved inflammation of the uterus four weeks before mating. No easy way exists for farmers to detect this condition; nor is there a current treatment. For this reason, we are focusing on solutions that support optimal transition through calving. Improving animal health during the 3 to 4 weeks after calving is a major requirement to improve cow welfare and
lifetime productivity through reduced health-associated productivity losses and fewer on-farm deaths and involuntary culling due to poor fertility and health disorders.

**Acknowledgements**

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**References**


The Path to Financial Sustainability

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Lifting financial capability within agriculture has never been more urgent. Financial sustainability will be essential to any farm business that intends to maintain the freedom to farm for as long as they choose. Our recent tradition of borrowing money to cover year to year cashflow shortfalls will only add more pressure to farm businesses going forward. A greater proportion of income will be consumed by debt servicing. This will be coupled with the inevitable rise in interest rates, increasing pressure on the allocation of cash within our farm businesses.

While capital gain takes care of the additional borrowings if the land asset is sold, capital gain offers no assistance to the cashflow demands of a farm business. Surplus cash must come from the simple equation of Income less Expenses equals Cash Surplus.

Agriculture is going to face some very big challenges from directions known as well as directions not even conceived yet. Yes, I hear the cries - agriculture has faced many challenges in the past and survived. I agree - I have been around long enough to have seen predictions of agriculture being “sunset industry” in the 80’s then lurch towards promises of the Golden Age of Agriculture in the late 90’s and the constant chorus of the world needs more protein.

Regardless of where we go in the future, cashflow is essential. The challenges as well as opportunities will be many and varied but they won’t be free. To keep up with developments and be able to position to reap these future benefits, farm businesses will have to have the capability to invest. Simply, you will need cash available for investment. Our businesses are going to have to be financially sustainable. They will have to generate surplus cash - genuine cash surpluses and they will need to occur more often than not – if not every year.

Table One below pulls data from the 2015/2016 Dairy Economic Survey (pp 54 & 55). The 2015/2016 is the most recent Survey available to date.

| Table One |
|---|---|---|---|---|---|---|---|---|---|
|   | 06-07 | 07-08 | 08-09 | 09-10 | 10-11 | 11-12 | 12-13 | 13-14 | 14-15 |
| Cash Surplus | -3,573 | 60,441 | -53,494 | 64,168 | 39,702 | -39,081 | 43,435 | 33,646 | -78,278 |
| Total Assets | 5,147,511 | 6,304,316 | 6,058,785 | 6,159,213 | 6,684,416 | 6,722,800 | 6,870,035 | 7,314,283 | 7,570,108 |
| Total Liabilities | 1,862,067 | 2,294,076 | 2,588,358 | 2,945,072 | 2,838,853 | 3,019,747 | 3,107,151 | 3,228,786 | 3,571,525 |
| Debt to Asset % | 34.7% | 34.6% | 41.5% | 46.5% | 40.0% | 43.3% | 43.7% | 41.9% | 45.8% |

Table One shows additional debt repayments or investment in industry or technological developments from cash surpluses are hard to find over time. The accumulated cash surpluses over this 10 year time frame comes to a total of just under $45,000. 50:50 share-milkers follow the same patterns with even higher debt to asset ratios.
There is a high degree of urgency to lift financial capability and have conversations around the financial capability of our farms. Is your farm financially sustainable? Do you hope it is or do you know it is?

Through my lens, I believe financial sustainability is currently the most important aspect of any farm business – simply put no cash, no future.

What does Financial sustainability look like?

- Cash surpluses (after all cash expenditure) are the norm and the expectation annually.
- The farm business has robust systems to help identify profit opportunities and risks in real time.
- The use of financial decision making tools are a key part of decision making processes.
- GST coding and processing is completed in house - ultimately by a key decision maker or effective reporting to key decision makers from within the business.
- Influence on profit is always part of the discussion - made easier through robust systems and well implemented financial tools and reporting.
- The financial capability of the key decision makers is assessed and accountability is embraced as a key driver of success.
- The key decision makers are honest and fearless about their individual financial capability. Financial decision making is never ignored, delayed or deferred to a third party.
- Up skilling of financial capability is demanded when required as it is clearly understood that the financial sustainability of the business is the responsibility of those who benefit the most and those who impact the profitability of the farm business.

Warning Signs

If any of these are present, you might benefit from spending time with me.

- Debt keeps climbing.
- Forecast cashflows show small surpluses which rarely seem to actually eventuate.
- Lack of confidence in your financial capability. Recognised as an issue across society not just farming.
- When meeting with your accountant do you nod and find they speak too fast but you keep that opinion to yourself?
- Are you excited to see the bank manager or relieved when they go?
- Are you surprised by what your accountant and bank manager tell you? Do you ever wonder if they have made a mistake?
- Do you wonder why the bank is sounding concerned? You think everything is fine.
- When do you complete your monthly financial administration (bill paying) – 19th of the month, 21st or hopefully before the 30th?
- Do you do your own financial administration, processing of GST, budget preparation and cash flow updates or have you shifted this responsibility to someone else?
- How often do you sit down to formally discuss your financials and review your financial plans? Every two months, once a year or only when forced to?
- Do you make excuses for why you don’t do these things?
Tools for Growing Financial Capability
Working towards Financial Sustainability
Clearly Identified Goals – written down

Identify goals that are exciting to you. Goals that are not exciting are unlikely to actually be what you want. Great planning tools and so much more can be found at www.dairynz.co.nz/business/planning/.

Once your goals are identified, you have a framework for the financial resources you are going to need. While none of your goals may be specifically monetary, some if not all, will require some financial resources. Written goals allow you to get clear on what you need. Decision making is easier as it either aligns with your goals or it doesn’t.

Not sure where to start? Ask for help!
A very clear picture of your Current Financial Position

The next step is to get a clear picture of where you are financially – your net worth and what makes up that worth. You need clarity around what you own, what you owe and any pressing financial issues that need to be addressed. This allows you to clearly identify the gap between your present financial position and your goals. This will fast track the creation of a plan for how to achieve your goals.

Not sure where to start? Ask for help!
Money Flow – where does it all go?

Next is a clear written understanding of where your money comes from and where it goes – all of it including personal spending! There has been an increase in the number of farm businesses looking at their financial numbers – working out farm working expenses per kg MS or perhaps break even milk price. This is great but it is often not enough to eliminate financial stress and build a financially sustainable farm business. To do this, you must be very clear on where all the money flows.

Not sure where to start? Ask for help!

You may be getting the feeling that there is nothing revolutionary in here. There certainly do not appear to be any silver bullets, secret tips or the one little easy to implement thing that magically makes everything alright financially. Sorry to disappoint, there is not going to be. However, that is great news. If you are searching for answers, it is highly probable you already know the answers. The challenge now is that you need to do the work to reap the rewards. Your efforts will be rewarded.

With clarity of the gap between your current financial position and your goals, you can take the first step towards achieving those goals – a budget for next season. I bet you are excited now!

A Budget

The power is in using the tool, not the name, so if you prefer plan or forecast – call it what you want but please never underestimate the power of creating and using a budget. This is where you may need a little patience. Financial sustainability is built one season at a time. This is the nature of farming - it is an annual cycle. Your budget may show slow progress initially but the solid foundation is being built. A solid financial base is essential for financial sustainability.
Why you need to do budgets yourself.

- You need to trust the numbers used to make it a useful and powerful tool.
- You need to understand how and why the dollar amounts are chosen as this helps bridge the divide between on farm and on paper. We all know there is often a big gap between what is on paper and what is on farm.
- You need to understand what the budget means to you and your future. It affects you more than anyone else so you need to believe in it.

Not sure where to start? Ask for help!

Forecast Cashflow

A cashflow will show you what is required on a monthly basis. It helps to ensure your overdraft facility is adequate to be able to make spending decisions based on when it is best on farm, not when it suits your overdraft limit. However, the benefit I like the most is the cashflow gives you hope. It shows you that while cash may be tight in October/November, it will get better. It allows you to plan spending for when you either have cash or alternatively how you will cover the expense. It actually provides optimism and hope on the occasional day when you wonder why you farm. But you do need to look at it regularly!

Why you need to do cashflows yourself.

For all the same reasons as a budget as well as

- If you understand the workings of a cashflow, you can use it powerfully to manage your financial future and radically increase the likelihood of achieving your goals.

Not sure where to start? Ask for help!

Variance Report – What you planned compared with what actually happened.

A Variance Report often self calculates in electronic cashbooks so there is no work required to create one. All the work is already done when you complete your GST reporting.

Variance reports reinforce why I believe it is important to do your own GST processing. You will understand how the numbers are coded and calculated. From there, you can understand where the numbers come from to make up your variance report so you will be more likely to TRUST the information. If you TRUST the information in your cashbook, you can faithfully use it as a decision making and management tool.

Have you ever not understood something? You knew there was no immediate negative impact if you gave up trying to understand. And as a result you did just that – gave up. That is what will happen each month with your financial management. This is how people go broke slowly and yet it is still a surprise when it happens. They never believe the numbers put in front of them. They never believe what people are telling them so surprises await. You are capable of so much more than that whether you currently believe it or not.
Feed budgets are a powerful tool alongside your financial tools as you can often identify on farm changes more easily and can anticipate changes in feed cover that will impact production and ultimately profit. The Dairy NZ website has some great resources on feed budgeting. With feed budgeting, the timing of management changes are enhanced allowing you to optimise the gains and minimise the losses which all contributes to more certainty in creating cash surpluses.

**Identifying these numbers provides a powerful feedback loop for you to track your progress towards your goals.** They also flag any shift away from your goals, acting as a prompt to review your management plans. KPI's are also useful when looking for the opportunities within your business to lift performance, both physically and financially. KPI’s can also help narrow down the amount of data you need to collect on farm. Often the raw data is already being collected or is easily accessible to calculate your own farm benchmarks or KPI's. What can make this step difficult is the data is not in a useful format. Frequently a little bit of help to set up some simple systems can make the process of creating and calculating KPI’s automatic. Farmers are regularly surprised by how little time and effort is required. There is a large amount of powerful information collected on farms that gets stuck in a notebook or on the shed white board that can easily become powerful decision making tools. An example of a good on farm KPI strongly linked to profit is 6 week in calf rate.

- What are your levers you can pull to lift profit or minimise costs and/or losses?
- What are your trigger points for making changes to inputs or management systems?

**Getting the point about help yet?** You do not have to work it all out yourself or do it on your own. It is often harder and slower on your own. Small changes or simple systems can have a large impact on your business. The hardest part is always summoning the courage to ask. Think about how much you love farming and you love your cows. Hopefully, it is a lot! I, like so many in the industry, love helping people as much as you love farming. So if you let me know you would like some help, you might just be surprised how much help you can receive and how many people are out there just waiting to be asked.

**My challenge to you is to take the time to reflect on these tools.**

- Are you using them to their full extent?
- Do you have goals clearly identified and written down?
- Do you know what your current financial position is and what it means in relation to how you are tracking towards your goals?
- Do you complete a budget and forecast cashflow for the season and possibly beyond?
- Do you sit down and review your variance report with other key decision makers?
Lessons from the Kitchen Table

Mind the Gap

There is a gap that you need to be aware of. It is the gap between the point where you should be concerned about the financial sustainability of your business and the point at which a bank may become concerned. These are different points and there is a gap between the two points. Nothing wrong with banks, they simply look at your business through a different lens. I believe this is why some people are genuinely shocked when the banks request system changes or additional debt repayment. Bank requests often come quite late and the options for change within the business are limited at this point.

If you have brought these financial tools into your business and are using them powerfully, you will see the gap in plenty of time. You will be aware of when your business is grinding the wrong way. Forecast cashflows will be showing a deficit before the bank sees it. Your momentum towards your goals will have slowed or stalled. Your plan D, E and F are not showing the cash surpluses you were looking for.

It is not much fun finding this place but the exciting thing about being the first to see this change in your business is you still have plenty of time to absorb the stall or change the direction of decline. At this point, most options are still available to you. By the time the bank expresses concern, you may have entered a downward spiral of high debt levels against volatile cashflows and shrinking equity. It is never fun farming in this space. But it is certainly not at this point when you give up. I have seen remarkable turn arounds in financial positions from some very deep holes. However, you will not be able to do this on your own. If you could do it on your own, you would not have got there in the first place – please just ask for help.

He or she who benefits most is responsible – The Power of Personal Responsibility

It is your responsibility to make your business financially sustainable as you benefit most from the financial strength of your business. In fact, as your business becomes more financially robust, others will take less from you. Banks receive less interest and fees, accountants charge less time, farm advisors can add more value in shorter time frames, you get preferential treatment for being a prompt payer and you have time and money to create a great working environment for staff and family which creates loyalty and pride in your business. You enjoy farming and are excited about the future. This is the upward spiral of success and an example of success breeding success. You are responsible because you benefit the most. Your efforts will be rewarded.

The Power of Compounding Interest

The Positive Power – Regular savings over time allowed to compound - which means you save a regular amount CONSISTENTLY over time and reinvest the interest generating a much larger amount of money than the amount of cash invested. Time is the key to this magic. The sooner you start, the better. The challenge is not to sabotage it by not starting until you have a large lump sum. Alternatively, you start then become impatient and shift the capital into a higher return, higher risk strategy - only to
learn the pitfalls of higher returns, higher risk options for your money. A good investment in learning no doubt! With all forces, there is an equal and opposite power.

**The Negative Power** – when losses are rolled into term debt and not repaid, compounding interest works against you. As debt levels increase, interest payments grow, principal repayments only increase the overdraft then loans become interest free and yet losses continue. This debt spiral always starts out as a short term loan to cover a seasonal shortfall. The problem is money does not fix money problems so this is unlikely to ever be a solution. It is difficult to farm out of a debt spiral – time works against you.

With robust financial systems in place and your increasing financial capability on track, you can pre-empt and often alter the path into this spiral. However, YOU must see it early enough. Only you will see it early enough as others look at your business through different lens'. This is not necessarily bad or wrong, just different for those looking in from the outside.

**Beliefs and Fears drive Behaviour**

- Have you wondered if your business is financial sustainable? Maybe not in those words but wondered if you are on the right track? Did you do anything about it? It is easier to go back out on farm and get busy farming, pushing the concern away, isn’t it?
- Do you avoid asking for help in case someone thinks you are a bit thick?
- Do you worry that if you ask for help, and actually get some help, that you still might not understand? Scary because then what will you do?

There is a magic moment to capture. That moment occurs just after you have asked yourself a question like “I wonder if I am on track?” In this moment, just after you ask a searching question, the opportunity to take action will never be greater. You will never be more motivated than in that moment. In that moment ring someone, ask for help from someone, just take some action. Because the very next moment is when doubt creeps in and then your beliefs (stories) kick in. This happens to EVERYONE and is limiting to everyone. Agriculture is full of clever people with untrue stories about their intelligence noisily banging around in their heads. A frustrating legacy of myth and stereotype of those who suit a career in farming.

Do you think you might like to feel more empowered about your finances, but assume you won’t be able to do any of it? After all, you were no good at maths at school even though it might have been 40 years ago and your teacher was fired after she taught you as a seven year old?

When we have a belief like “I am too thick to learn about my finances”, your mind will search for all the examples in the past to validate that belief. It will search out more evidence in the future to maintain the familiarity of your chosen belief. You will ignore all the amazing skills you have developed as a farmer as they will not fit with your story (belief). Everyone does this - seeks evidence to validate the stories (beliefs) we have created about ourselves. The stories become so familiar over time, we believe they are true and never question where the story started and if it is really true.

I want to challenge this as I have met many “self-diagnosed thick farmers” who are my definition of very
clever. Over time, with a little effort and a bit of work, they find the slightly alarming evidence that they are actually not thick as they are able to grow their financial capability. I always wonder how many other farmers are out there limiting themselves by the stories they tell to themselves. Never questioning if the story they tell is true. Let’s find out together - you might be surprised!

**Money does not fix money problems**

This brings me back to why money does not fix money problems. Money is a symptom – the cause could be a farm business that simply is not viable. It could be a farm business carrying too much debt and not producing enough saleable product. It could be the struggle to produce enough grass to milk enough cows to produce enough milk to meet the costs of running the farm. Sometimes there is enough grass, there is enough milk but the money just does not seem to be there at the end of the season. Sometimes the lack of money is a symptom of a belief or story that is sabotaging your financial success.

You see this play out when the farmer is just about to clear the credit card then an overseas holiday gets booked – business class! You see it play out as just about finished the ute repayments then the ute is traded in for the latest model. Or maybe just about repaid the loan on the bike then absolutely need to own your own tractor, big enough to do any job – you know, just in case you want to go contracting for extra income one day. Or you are finally able to make cash surpluses 8 in every 10 years then you decide you have “lazy capital” so you buy another runoff so you can do more beef. Our brains seek the familiar – if you are familiar being financially challenged, although it seems like madness, your brain and your beliefs may just be getting in your own way and sabotaging your success.

**Too “woo-woo” for you – Fair enough! Go back to the top and start there.**

- Do you have goals clearly identified?
- Do you know what your current financial position is and what it means in relation to how you are tracking towards your goals?
- Do you complete a budget and forecast cashflow for the season and possibly beyond?
- Do you sit down and review your variance report with other key decision makers?

This is a great place to start and if you find you are implementing all these hard skills but still looking for more, you may just need to come back for a little bit of woo-woo belief/brain stuff. After all, it is your future we are working towards and ensuring your farm business is financially sustainable. Let’s do whatever it takes – your efforts will be rewarded.

I welcome comment and debate of the topics discussed here, please do not hesitate to contact me at bex@bexwarburton.com
What’s After Success?
Tony Hammington and Rhodes Donald, April 2018

Three years ago, Rhodes began a study of the lives of retired farming couples. What had changed for them, how had they coped, what had they learnt and what could they share? After a life-time of advising business owners and farmers on the money aspects of retirement Rhodes wanted to dig past the legal, accounting and money stuff, and find out what retired farming couples were doing in retirement and how their new lives were panning out emotionally, physically and mentally.
Questions about their previous careers before farming, how they got onto their farms and all the way through to the advice they had for other farmers preparing for a life after farming, were included.

The Book
The book, simply titled Life After Farming, summarises the interviews along with conclusions. Prior to the Conference the book is available for reading on-line at Rhodes’s website, see Life After Farming.

The Conference Workshop
The workshop will guide you through a similar process. We will be asking you to think about your process for exiting farming and preparing for building your next life, after farming. For some of you, your lives after farming may be longer than the time you spent farming, so some thinking and planning at this crucial period in your life should reap some personal benefits for you.
Succession is not a transaction, but a circular journey. It is not mandatory that involvement in the farming business stops suddenly. Farmers may want to take on “light duties” that are critical to the success of the business where they bring a high level of skill, are dependable and pragmatic (and are drug free!)

Exploring personal and business goals with objectivity and a collaborative approach will help families and business stake-holders achieve win-win outcomes.

Think, Share and Discuss
Will it ever be as good as life on the farm? Of course, it can, but it is still just life. We won’t change inside. It is not a magical destination but a process that includes living with the issues and opportunities of ageing.

The challenge of work/life balance is often front and central on the agenda for younger generations. As Susan Gretchko said, “We tend to think we have a business life and a personal life. We have 1 life and it is very personal.” It can also be a thorny issue for those looking to pull back on their involvement in farming, with several implications, such as the timing and location of changing residence, new activities outside the gate, staying healthy (mentally and physically) and the security of social networks.
If you have a chance to read some of the book on-line before the Conference, that might help, but otherwise, come along prepared to think, share and discuss your thoughts about life after farming. The workshop will be a mix of reflection, new ideas and old ideas, mulled over, tested and shared.
Next Millennium Farming

Stuart Taylor

Our dairy industry and what it offers to employees has changed over the last 20 years however our employment management and employment strategy has remained the same, so why are we surprised we are not attracting talented people to our industry anymore?

Background:

- Grew up in a dairy farm in Northland where the workers lived with us in our home.
- Dairy farming was about people working together helping each other to look after cows.
- Growth path was the through working hard, sharemilking and then farm owner.
- Currently owner operator of a 3000 cow (3 sheds) operation west of Bulls in the Manawatu.
- Staff are sourced from the local community and as far as Wanganui (30 minutes' drive)

What we had when I was growing up:

- We were developing a new country.
- NZ wanted productivity and we had the blessing of urban NZ.
- Your farm was your home and you had real control of that land.
- Strong rural communities supported each other.
- There was a real belief that if you worked hard for 10 years you could buy your own farm. This belief attracted people to farming.
- Average farm size was under 150 cows.
- People that worked on farm were part of the family.

When my business grew and I tried to apply the same principles that I’d grown up with. I advertised to attract people to work in my business but kept on getting interest from the wrong crowd. Something had changed and I needed to understand what.

What did I hear when I truly listened?

- Farming systems required higher levels of decision making and skill. Systems have intensified and the type of people required to do the job has changed. Not just anyone can now be a dairy farmer.
- People no longer believed that they can work towards farm ownership. So the drivers behind the choice to come work in the dairy industry are different.
- Social change has changed expectations around how we employ people. The husband-wife home partnership had changed. Men working 70-80 hours/week while women take care of everything else does not work anymore. Both parts of this partnership are expected to be present in their family with their kids, and women want to be involved in providing for their families. This puts extra pressure on people if we work like we have in the past.
- NZ society wants us to act differently and they have the numbers to force change. Society is
not willing to turn a blind eye on things, they are much more aware and they demand we behave differently while conducting our business.

What people actually wanted from coming to work for me:

- Good people to work with. Good workers have a choice today as they have easily transferable skills into other industries. They want to come to work for good people and work in a good environment.
- Market rates for pay.
- Flexibility to get to important events
- Help towards their aims and dreams

So I had to change how I ran my business in terms of how I manage and lead the people in my business. I needed them to come work for me, so I had to change:

- I found out what people wanted and helped them: if they want to run their own business in the future, I help them gain the skills they need to do it. In the meantime I get an interested and motivated person working for me, striving to do a good job.
- Win Win with people - Job sharing for couples: Many partners remain at home, some getting depressed because they have nothing to do and they feel useless. By job sharing, each partner is able to work and support the family with an income, spend time with their kids, and feel they are a productive part of their community.
- It is a competitive market for people – how do I stand out? This is where rosters and good pay come into play. If you want to hire good quality school leavers, advertise a job they will like.
- Get the right people on the bus - Good productive people: being able to discern who will and won’t fit became key to ensure the right people joined our teams
- Decisions = Ownership not Ownership = Decisions: We tend to feel that now that we own this business (we have the financial ownership) we will decide how it runs and how the people in it will work and what they will do. This thinking disempowers people. If we want people emotionally owning their activities and the work they do, we have to let them work the way they want, as long as the focus remains on the right end result.
- Understand my culture – my expectations (find people that fit): self awareness is key to lead others. If I can’t manage myself, how can I manage anyone else?
- Train people and then empower people to succeed: training without empowerment makes people bored and disengaged. Empowering people without training can be dangerous for themselves and for your business. Train people well and then empower them to do the jobs by themselves. This is effective delegation.

How we do it

- We are professionals, driven to succeed and our work is completed to a high standard. Every day we make it better.
- We protect the life and welfare of the people in our group. Do it safely or not at all. Make the
call to keep safe.

- Animals are treated with respect and care – Care for our Cows
- Celebrate success and failures - they both teach us. Everyone’s ideas are important, and it is the responsibility of everyone to solve problems. Celebrate the now.
- We adapt and change quickly when the situation requires change. It is our strength; we are good at change.
- Feedback makes it happen from the team to management and from management to the team. Challenge with respect.
- Team game - Everyone is treated fairly; all people do all jobs. Prejudice against another person because of their gender or ethnicity is wrong. No-one is more important than the team.
- Simple systems help the team succeed.
  - Everyone is 100% responsible for their own actions. Take Responsibility. We are all leaders.
  - This is a safe place - check your intent and have the courage – Say it - say the things that are needed to be said to protect our culture.
  - We bring into our teams “Good Productive People” The way we behave is as important as productivity.

Order of focus:

1. People (includes community)
2. Animals
3. Innovations - Profit – environment
4. Production
5. R&M – Development

Questions to ask yourselves:

1. Farming is the greatest job in NZ – Why do we make it so hard?
2. It is a competitive market for good people – what are you going to change to get good people?
3. Change is being forced on you – what are you going to do?

Wealth is created by ideas and innovation. As an industry we have forgotten the “innovation” part and remain repeating patterns that no longer serve us well today. The only way to survive in a rapidly changing world is to embrace change and go back to what we are great at and that is “innovation”. It’s ideas that create wealth.
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Water Matters – Midway Dairies

Kieran McCall-Director, Midway Dairies

About Us

I would like to start by telling you a little about how it is that I got into dairy farming, and eventually to be here in front of you today.

For the first 27 years of my life I had absolutely no intention of being a farmer let alone a dairy farmer. I grew up on sheep & beef farms in Otago & Southland, but after leaving school headed off to Christchurch to study civil engineering going on to spend 5 years designing structures in Christchurch and around the country.

In the meantime my parents had sold their sheep and beef farm in the Hokanui Hills and got involved in dairy farming.

After taking a break from engineering to do some travel, some help was required on my parents farm at West Otago, so I thought why not? Some staffing challenges meant this was extended for the rest of the season. It was an interesting experience as all of our family was involved in running the farm that year, none of whom had the experience to do so, so we learnt a lot very quickly! During this year, following a blunt ultimatum, my partner Erin and I were married.

At the end of the season we had no plans to get into dairy farming and wanted to do some more travel, heading around NZ and picking up bits of work along the way.

Day one, we made it to Christchurch. The next morning, not long after Erin had popped out to pick something up, she informed me that she was pregnant. At this point “shit got real”.

We carried on with our travels but didn’t make it too much further before it became rather difficult due to the multiple vomiting episodes. With travel over and a baby on the way I realised I needed to find a job!

After two years working on a multi farm operation near Temuka the family farm at West Otago was sold and we purchased our current farm just south of Ashburton. Erin and I are equity partners and run the farm as lower order sharemilkers with my parents Graham & June as the majority shareholders.

We have just finished our 7th season.

1. Our Farm

- 162ha effective, flat
- Seasonal milk 620 crossbred cows
- All cows wintered off farm and young stock grazed off
• 3 full time staff
• Fully irrigated, water sourced from bores, irrigation equipment includes pivots, rotorainer, k-lines & sprinklers
• Effluent system includes 800m³ above ground tank, spread by travelling irrigator

2. Importance of Water

Water is obviously a critical resource for us to be able to undertake our operations, and this is magnified for an irrigated farm such as ours. Seeing as Olympic swimming pools seems to be the standard measure for water volume I have done some calculations of what we use on our farm in a year. It is clear that irrigation is where most of the resource is used.

As an example of how important water is to our operation I have examined the pasture growth rates during our first year of operation. It shows a feed deficit of approximately 136t, which is probably in the region of about $60,000 or feed.

This was caused by a 21 day irrigation pump failure which at that time meant a 80% irrigation restriction.

3. What are the issues?

It seems the age of the media being a fact based medium has moved on to a strange place where information can be shared so easily and quickly that it can be very difficult to establish its credibility. While people can be fooled and systems can be manipulated we can’t fool the environment.

No matter where we live in the country we all have issues to manage and resolve around the sustainable use of water. The issues, questions that need to be asked and answers will vary from community to community. Regardless of location we are all facing increased public and consumer scrutiny and the farming practices of the past will no longer be sufficient in the future. The public have a strong connection with water and it forms part of our identity. They want to know:

• Are farmers using the resources efficiently?
• What effect is farming having on the environment?
• Are farmers doing enough?

The following are some of the issues we are facing in our area:

• Water allocation: we don’t really know how much there is. We have now decided that too much has been allocated.
• The farming landscape has changed dramatically in a short period of time
• Nitrate levels in surface water and shallow ground water are at levels which pose risks to drinking water quality and aquatic life
• Regulation has come in that requires farmers to make improvements, there is a lot of uncertainty around exactly what this is going to mean on farm
• Overseer is being used beyond its current capability, is subject to manipulation and is expensive
to use (in my opinion)
  - Results of the monitoring of the water quality is difficult to obtain, should be more prominent
  - Are we going to be charged for water use & nutrient leaching?

4. **What do we do?**

We are all going to need to be prepared to invest some time to understand our local issues, others points of view and the risks that our businesses are exposed to.

**Do Nothing**

  - Problems get worse
  - Fixing later will be more painful
  - Regulatory stick gets bigger
  - May change to input based controls
  - Negative affect on public perception
  - Loose opportunity to get on front foot
  - Upset consumers?

**Do Something**

  - Might not choose most efficient use of capital
  - Might not get immediate reward (overseer)
  - Might lose ability to utilise improvements in terms of regulation

**Community**

  - Understand their point of view
  - Help solve their problems
  - Build tolerance
  - Strengthen relationship
  - Need to consider consumer

**Media**

  - Fact no longer the basis for news
  - We have not been as effective as we could be
  - Hard to defend ourselves without taking positive action

**Environment**

  - We depend on the environment for our livelihoods
  - Need to be able to prove our effect is manageable
  - Compliance is here, we need to extract as much value as we can
Our current regulation requires us to have measured our baseline nutrient leaching which is the average value generated from overseer over the years between 2009-13. These must be prepared in line with some specific good management practices. From here we must operate below this baseline and make reductions of 15% by 2025, 25% by 2030, and 36% by 2035.

**What are we doing?**

*a) Irrigation Changes*

Lots of low hanging fruit, a lot of things that improve environmental outcomes improve financial outcomes.

- Installing soil moisture probes, better scheduling
- Install water meters and telemetry system to monitor water use, consent requirements, text alerts when set parameters are breached
- Install more efficient irrigation systems (pivots)
- Decrease irrigation intensities by spreading water wider, the bigger the pivot the higher the intensity
- Reduce rotorainer return interval to 6 days and re-nozzle down to 18mm min depth
- Create sprinkler maps and re-nozzle sprinklers, shift TAD
- Shift saved water from sprinklers/end gun to pivot, avoiding soil moisture deficit gives more efficient use of water
- Bucket testing of systems and irrigation NZ app

*b) Irrigation Learnings*

- We have had issues with both new pivots with application depths, particularly end guns, need to bucket test
- Being able to set text alerts for system a big help to manage consent requirements, instantaneous flows and combined pump volumes
- Get someone experienced to install soil moisture probes, location and ground re-instatement very important
- Get probes calibrated, and spend time with providers to understand the information they give you.
- Soil moisture probes have given us confidence about when to start and stop irrigation & have led to water savings but effect is over represented in overseer model.
- Smap is a good resource to get an understanding of soil properties at a large scale.
- Some of the improvements we have made can be modelled in overseer and some currently can’t.
c) **Effluent Changes:**

There were many options to consider when upgrading our system, we aimed to minimise capital input and do our best to consider future options such as running effluent through pivots

- Increase effluent storage using DESC, 800m3 Tasman Tank
- Decrease shed water use using solenoid valve
- Change effluent consent to be able to spread over whole farm
- Increase effluent mainline
- Modify pivot to be able to run traveller from de-commissioned underslung line
- Bucket test to get application depth & test effluent to get nutrients applied

**d) Effluent Learnings**

- Very important to understand soil type, big difference in rules for application and storage between high risk and low risk (smap)
- DESC sensitive to volume applied
- Accurate dairy shed water use important
- Extra storage volume has given management tolerance
- In summer can store enough to spread effluent over a whole paddock & reduce N applications
- Cut-out system means can run at night time, two runs a day if required
- Harvest records keep an accurate record of where effluent is spread so fertiliser can be varied
- Maps/markers have eliminated incorrect positioning
- Able to set up text warnings for pressure or speed
- Can identify issues with spreader performance from pressure/speed graphs
- Larger storage and increased holding times is leading to a solids issue in tank
- Cleaning with a digger led to holes in liner
- Very difficult to empty a flat bottomed tank, shape bottom

**e) Other**

- Use of plantain in pasture mix
- Hosting ITO classes on farm
- Involvement with Dairycan, projects that we are working on include social media videos, Coe’s Ford water quality

**Future plans and options:**

- Timer cut-outs for k-line and sprinklers to limit application depths?
- Set sprinklers?
- GPS for sprinklers?
- Soil mapping?
• Re-use treated effluent for yard wash?
• Records for effluent application recorded in precision tracking to combine with fertilizer applications for automatic entry into overseer, plus automatic reduction for urea spreading where effluent has been applied in future??
• Hinds Zone, managed aquifer recharge looking positive

Summary

In summary the key points from my presentation are:

• Take some time to understand the views of others and risks to your business
• We can’t affect anything positively without taking action
• Act now to keep as much control as possible in our own hands
• Get involved with the community to share stories and educate others

Our ultimate responsibility is to the next generation.
Water Matters – Maruakoa Farm

Lyndon Strang - Maruakoa Farm, Otago

Lyndon Strang Bio

Lyndon and Jane farm at Five Forks inland from Oamaru. They milk 430 cows on their 230ha effective farm as well as raising all replacement stock and wintering their cows. Lyndon is Chairman of the Kakanui Water Allocation Committee and Dairy Chairperson (North Otago) for Federated Farmers. Through these roles he has been active in the re-establishment of the North Otago Land Management group to actively improve water quality in their catchment.

Introduction

The management and care of our countries water resources is an issue that is of high importance to a significant amount of the community as well as our international customers.

These desires impose a pressure or tension in how we manage the quantity and quality of our water. Irrigation, recreation and cultural activities sometimes pull in opposite directions and it is sometimes overwhelming to see a way to a solution where everyone can get what they want.

During the last election campaign I commented to a non farming friend that if you were a farmer you felt a little targeted, if you were an irrigating farmer you were get really picked on and if you were an irrigating dairy farmer you were the single biggest cause of most of the country’s problems!!

We need to put this “fake news” behind us and acknowledge that there are problems in certain rivers or catchments and that there a lot of others that are in very good health. Where there is a problem we need to fix it…. That’s who we are and what we do well. Farmers like to get their boots on and get stuck into fixing the problem.

Water quality is no different to any other issue our sector has had to deal with. We will fix this problem and we will come through this stronger. It will take a change in the way we do things, it will take leadership, it will take education of the wider community and it will inevitably cost us but it must be done.

The alternative of increased regulations, negative public perception and possibly marketing issues if our provenance story does not match our reality.

Water quality is a long game and the negative results did not happen overnight and likewise will not be fixed instantly. On farm changes we make today may not result in a positive water quality outcome right away so it is important that we communicate and educate other stakeholders on what is being done on farm and our acceptance to resolve the issues as we continue down this journey. This education includes local and national politicians and policy makers on what we have done and what
we are in the process of doing. Crawling into our holes and keeping our head down is not going to make things better.

Our Story

Today I want to take some of your time to tell you our story around water and how and why we made decisions and took the actions that we did. 10 years ago the topic would have been “irrigation infrastructure” but we are now talking about water management – irrigation is just the bricks and mortar that puts the water on the ground, water management includes securing water resources, monitoring and managing water quality and future proofing the resource and our businesses.

My wife Jane and I farm on Maruakoa at Five Forks, 20min inland from Oamaru. Jane’s family, the Isbister’s are 4th generation farmers in North Otago. (Slide – Map, Farm)

Our background is important to who we are now and how we approach our farming business and managing our resources so I want to take some of your time with a 30 sec run down on us.

Jane left school did an Outdoor Education diploma and was an adventure tour guide for a number of years. She will deny it but she was a hippie – owned a combi van, had a paisley dress, vegetarian and hung out people who played with fire pois. She thrived on showing visitors the best of our countries nature while scaring the hell out them along the way.

My story is a little different I grew up in Alexandra and saw first hand the effects of drought and rural down turn. I joined the Navy in 1992 straight out of school and was lucky enough to be chosen for a three year university scholarship. The government was paying and within reason I could do pretty much anything. I chose Geography with a major in hydrology. Not many rivers in the middle of the ocean and this degree did not make me a better fighter of sea battles but it was interesting. Water fascinated me (and still does) and even then there were pressures on it, how it was managed and monitored. The water quality issue was a minor part of the studies and still gathering momentum as an issue in New Zealand.

After a career change into the corporate world and a couple of kids we decided that a move from the city to the country was our calling. We had a desire to run our own business and give our children the opportunity to grow up in the country.

In 2006 we threw in the big city jobs and came to work for Jane’s parents as dairy assistants!!

Our ideological bubble had well and truly burst. We faced some real challenges in the first few years. Five Forks is in the shadow of the Kakanui ranges and has very low rainfall (~500mm). Like most of the east coast drought was common. Our irrigation water came from a run of the river consent off the Kakanui River which just when we needed it went on restrictions or off completely. We had a cycle of drought with good payout that we couldn’t maximise followed by a drought with a low payout which dropped us into a financial trench.

After several years sharemilking for Jane’s parents, Murray, and Lynne, they saw that the door to freedom was slightly ajar and made a run for it. Succession planning went into full swing and we bought the farm in 2010.
Our future was now in our hands and we set in motion a plan to manage our risks and put more certainty in our income. We needed to remove drought as one of the risks to our business.

Our approach to water management in order of priority:

1. **Quantity** – Secure our water supply through water storage, Seek alternative more reliable sources - Waitaki River water through NOIC.

2. **Optimise** – Use the water we have as efficiently as possibly through smart technology, improved application efficiency, proof of placement for increased accuracy, moisture monitoring, night time pumping and infrastructure upgrades

3. **Secure the Future Sustainability of Our Water** – Quality issues, Environmental farming, Getting involved to control our destiny: Federated Farmers, NOSLaM (Catchment groups), Kakanui Water Allocation Committee. “If you’re not around the table you are on the menu”

This approach was designed to allow us to achieve our goal of running a fully self-contained unit: 200,000kgms per year from 430 cows; all cows wintered on farm, R1’s and R2’s grazed on farm all year and enough supplement made for lactation and winter. We are not quite there with our production target and some bought in grain but it is achievable. Our system was put to the test during the last down turn. We found it good to have all stock classes on farm which allowed us to keep our FWE low during tight times.

The farm is 289ha with 230ha effective on 30% river flats 70% heavier clay soils on rolling hills. This season the milking platform will be 150ha and 80ha dedicated for support. The non-effective land has approx. 50ha of trees – predominately pine and gums.

**Irrigation Timeline (Slide)**

- 1960s-1993 Mining Right (one only 2 on the river) and Flood Irrigation on river flats only. Sucked the river dry and didn’t achieve much.
- 1993-2005 Farm was a support unit. Irrigation by big gun – high application rate long return, placement average due to wind. Small amount of K Line
- 2006 Farm converted to Dairy – Irrigation moved from Gun to K Line. Improved round length. Lower application rate. 150ha Irrigated
- 2009 Upgraded effluent system and storage. Approx 40 days. Low application rate system.
- 2011 180,000 cummec Lined storage pond – 11m deep, 250m x 150m.
- 2013 40 Shares in North Otago Irrigation Company expansion into Five Forks.
- 2013 Infrastructure upgrade: Semi variable system for K Line with timers and alternating zones to assist with infiltration and placement.
- 2016 Infrastructure upgrade: 2 Pivots.
- 2017 50 Shares in NOIC expansion into Kakanui Valley. Fully irrigate 230ha eff. Reduced day time pumping from river.
Future  
(Slide)

- Possible hydro generation in replacement of major PRV. Going through cost benefit analysis.
- Additional pivot on sedimentary river soils. Lower application rate, better return rate for shallow sedimentary soils.
- Fixed grid in paddocks not suitable for K Line or Pivots.
- Reviewing land use of river flats that are in the ORC Kakanui Nitrogen Sensitive Zone: 40ha.
  Diversification, Cut and carry, young stock only, etc
- Riparian enhancement, buffer zone development and track improvements. Aim to reduce sediment and nutrient runoff.

Sustainability of Water

The main area I would like to focus on today is looking at securing the long term sustainability of our water which is directly linked to the economic success of our business. Without reliable and cost effective water our farming business would be severely put at risk. Several years ago we redirected some of our focus into predominately off farm activities around the water space. There are four main areas in and around sustainability that I want to look at:

1. The Risk of doing nothing
2. Good Management Practices
3. Leadership
4. Collaboration and education

The Risk of Doing Nothing

We need to understand and accept that others have a say and hold a value in the water that flows through or around our farms. It may be cultural, recreational, or even just a belief or desire on the state they want water to be in.

Central Government have and will continue to set regional councils goals or targets to be achieved for freshwater. As long as the public (government) believe that freshwater needs improving these targets will continue to be churned out of the policy machine in Wellington to be interpreted differently by our regional councils and set to play in plan change after plan change.

We need to be under no illusion that plan changes will occur in the future if we do not meet the water quality targets. Doing nothing is not an option and we must demonstrate that farmers are doing our part.

A lot of good work has been done already and we need to continue to communicate these successes without resting on our laurels.
Good Management Practice is better than “I’ll do what I’ve always done” Management Practice

Implementing good management practice on your farm is important. Most agricultural organisations, Regional Councils and catchment groups have lists of proven GMP that will benefit water quality on your farm.

Keep up to date with the science and be brave to try something new. The science and research community are scrambling to keep up with farmers demands on how we meet environmental limits or consent conditions – give us N reduction feeds, a drench that will reduce excreted N, cost effective precision equipment, increased Overseer accuracy, the list goes on. We are in the unenviable position where we do not have time to wait for all the science to catch up or be published. We need to try some of these new technologies.

It is important to keep in mind the idea that if everyone makes a small change or improvement the cumulative effects of this will be significant. Many hands make light work and the same applies in catchment management. We are lucky with in our catchment group a wide cross section of farmers not just dairy. The majority of them accept that all land use contributes to water quality issues in some way and we are all part of the solution.

I believe that it is important that agriculture and dairy get some quick wins on the board in the water quality space. We need to look at what the public and the government are focused on. It is “swimability” and the visual presentation of waterways. These are fixes that a lot of rural communities have or are putting in place and may be some of the easier challenges to address.

Success with eColi, sediment and stream bed enhancement will demonstrate that the issues are being addressed and also open the way to a robust conversation around other limits such as NNN and DRP. We must let the independent data do the talking through Regional Councils or the State of the Environment monitoring.

If farmers can demonstrate that improvements have been made it provides a strong platform for discussion especially if some of the other levels are just not obtainable in certain catchments.

Leadership

The fact that you are here gaining knowledge demonstrates leadership. You are arming yourselves with tools to improve and enhance your dairy business. We now need to bring environmental considerations further up the ladder in our core decision making process. Does it make good economic sense, and does it make sound environmental sense? This is complex when there is no immediate value to an environmental decision and the scale of your impact is hard to quantify.

Our businesses are just as much at risk to government legislators internally as they are to external market fluctuations.

Leadership can be a neighbour making a change to their operation after looking over the fence at what you are doing. Sometimes leadership happens when you least expect it or you don’t even realise you are doing it. In 2010 I restricted all stock access to part of the river that runs through our farm. It was grazed by dries when feed was a bit tight. Our neighbour casually asked why I did
this and the following summer he had installed over 1500m of netting fence on the opposite side of the river to keep his sheep and cattle out. He was the type of farmer that didn’t go to field days or discussion groups but he had made a positive change towards enhancing water quality.

For those of you that have inclination and skills it is also important that we take the lead and not be afraid to tell our story and share our successes. There are so many ways now of communicating our message and not one source or method is the silver bullet. The public and our customers need to be hearing the good stories from all angles and most importantly seeing it in real examples and independent results or testing.

Collaboration and Education

Water quality is everyone’s issue and we need to continue to push the idea that we all can contribute to the solution. Weather we are in the middle of Auckland City, a dairy farmer or a high country farmer we all contribute to the issue in some way and are all responsible for its resolution. It is not just a dairy farmer’s problem!

At the start of our catchment group process it was amazing how little the other stakeholders knew about what we did on farm, the irrigation audits, Farm Environment Plans, regional council spot checks, Fonterra Dairy Inspections, not to mention the amount farmers had already spent on water quality related initiatives – effluent upgrades, riparian plantings and fencing.

In the catchment group farmers also took the time to understand the other stakeholder’s point of view. What was important to them, what did they value in our river. Our catchment group facilitator went into the local schools to work with them on river projects. Rural children were encouraged to look at the river from other perspectives which created some interesting questions around the dinner table.

Farmers went to community planting days at the Kakanui township at the mouth of the river and we got community assistance at similar days in the rural areas. This was symbolic to everyone that we were all prepared to put effort into the water quality issue together. The talk over planting a simple flax was breaking down barriers and contributing towards education on both sides.

It is extremely important that we continue this relationship and education process as we go through the water quality journey. We need to demonstrate to the wider community and other stakeholders the on farm changes that we are making and the effort we are going to maintain or improve our water quality. As mentioned it will be a long game and we need the understanding from the community that a lot is being done. It is not perfect but a great deal of effort is being made and we are a long way through the journey.

Conclusion

- Doing nothing is not an option. We do not have the luxury of standing still.
- Implement GMP. The cumulative effect of even small on farm changes can be significant.
- Show leadership – Make changes, get involved, be brave, try new things.
• Share your experiences. There are plenty of people telling us what we have done wrong; we need to show them what we have done right.
• Take the time to understand others point of view. Personalise it in your catchment.
• It is going to take time and we may not see instant gratification. Be prepared for that.

Ultimately it comes down to that fact that I do not want my generation handing over a problem to our children. I believe we can have a healthy environment and a strong farming business.
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1. What is a nudge?

Dairy businesses are the backbone of our economy. But, they are under the microscope. Water quality. Greenhouse gases. Animal welfare. The nation is becoming polarised as concern is growing around what people believe happens on dairy farms, be it correct or not. The negative impacts of fake news and uncommon outcomes are even more profound in an era of social media. Polarisation can mobilise a society to action. However, most often it ends up in fruitless arguments and we lose focus on the real issues. The middle ground disappears, as well as any empathy and trust that are the foundation of moving forward. We exist in a time in which members of society need to better understand what we do and how we do it.

The impact of agriculture on the environment depends on our choices, and there are opportunities for us to do better. One powerful way to change behaviour is called the ‘nudge’. A nudge is all about making it easier for people to make a different choice, without reducing their options or impacting them financially (Thaler and Sunstein, 2008). Even very small changes in the way a choice is presented can lead to big changes in the decisions people make. The key things about nudges are that they are small, subtle, easy, and cheap. They are all around us. However, they have even more to offer. We can use them to profoundly impact our staff; neighbours; industry; communities; and, ultimately, ourselves.

2. How do we nudge?

We live in a complex world. We make thousands of decisions a day, many where we rely on instinct. Economists divide decisions into ‘slow’ and ‘fast’ types. Slow decisions are the ones we really think about, while fast decisions are more automatic and instinctive (Thaler and Sunstein, 2009). Slow decisions are infrequent and usually involve items that are more costly and important. Examples are whether we will buy a new tractor or change the type of supplement we feed. We don’t have all the time in the world. We have the farm, the kids, the wife, the mates, and many other things that we need to pay attention to in our 24 hours of today. So, if we are making only slow decisions, pondering each decision in much depth, then we can get overloaded very quickly. That is why humans make many ‘fast’ decisions that draw greatly from experience and things in our vicinity when we make the decision. Nudges work on these fast decisions. They are justified on the logic that if people are making rapid, instinctive decisions then there is the chance that small changes in the context of that decision could lead people to make choices that are more favourable for themselves and/or others.
Nudges can take many forms:

1. The provision of user-friendly information through advisors and written material has been a favoured method of communicating with farmers for as long as anyone can remember. Indeed, government or industry groups have been supporting pastoral farming through the delivery of information since the establishment of the pastures on which our businesses are built.

2. Similarly, we can persuade people to make better environmental choices. We can do this by proposing that people will make more money using a certain practice or by appealing to their emotions. Stream fencing can help us make more money by reducing liver-fluke ingestion, making mustering easier, and reducing stock losses. On the emotional side, we have found that it is easier to achieve practical outcomes when people are truly invested in change. If a community rallies around a waterway where everyone has swum and collected kai for years, then they are already halfway on the journey to restoration. Some say that appealing to the financial argument is not exactly a nudge, but we contend that it is and can be a very important one. On the other hand, appealing to emotion is powerful and reminds us that it is not all about dollars and cents.

3. We can also try to adapt or establish social norms. This helps to change behaviour through influencing social norms. Drunk driving was once more commonplace in rural areas. The same appears true for smoking. There is also momentum through the dairy industry associated with fencing streams and the responsible management of effluent. These changing norms help to promote the spread of best practice, encouraging large benefits from small social changes. The hard thing here is how do we establish social norms? It can be difficult, but broad-scale advertising and role modelling from top farmers are often seen as key options.

4. We can also compare performance among peers, by providing benchmarks. We can hold forums or advertise the positive impacts that environmentally-friendly farming techniques are having. This helps to stimulate positive performance, though we must make sure the leaders do not become complacent!

5. We can also nudge people by changing default choices. Most people just accept the status quo option. An example is Kiwi Saver, where you have to opt-out of investing in the ‘conservative’ investment fund. Similarly, it is the default choice at some stores to not give out plastic bags. These could work in the environmental space. However, I think suitable ways to achieve this are less clear than for the other methods, because many key farming decisions are not mediated by regional or national government.

3. What are the pros and cons of nudging?

Nudges are valuable because they can provide large impacts from small, inexpensive actions. They are a refreshing alternative to regulation, which some call a ‘budge’. The reality of policy making is that not everyone in a population is resistant to change. Regulation is mainly relevant to the people who are. Regulation is also a good way to ensure that there is resistance from the very people who need to implement the change. This can be costly, in both monetary and political terms.

Evidence worldwide shows that nudges need to be well designed to really get the most from them. Like anything, they have their limitations. It can be hard to change ingrained habits. If you have ever tried increasing cell-phone adoption among 70-year old sheep farmers, then you will know what
we mean! It is also difficult to predict how people will respond to the same nudge. This highlights how we need to pilot strategies and see how they influence different people. The impact of nudges can also be short-lived. Nudges are often small and subtle; thus, their ability to influence decision making when they are not there anymore can be limited. This reinforces the importance of persisting with nudges to encourage habit-forming. Some types of nudge can also be viewed as manipulative. Nudges rely on trying to influence people to make a choice that others decide is in some way ‘better’ than an alternative. Some see this as interfering with a person’s freedom to make their own decisions, especially given that most nudges will be implemented covertly.

4. Nudges in the dairy industry

Nudges can be used to change the way we progress, both individually and together.

We can nudge ourselves. Checklists and apps on our cell phones can help to ensure that all important tasks are done, even when some may perceive them as less important than other decisions. One example is the need for regular health and safety checks.

We can also nudge our team. One example is the outline of a tool on the wall in a tool shed, which helps to make sure that items are relocated in the right place. Another is the DairyNZ program that encourages staff to monitor water use (DairyNZ, 2018). We can use similar strategies to get buy-in to reduce the environmental footprint of the farm itself.

We can also nudge our neighbours. Discussion groups (formal or informal) can help provide motivation, keep topics front of mind, and allow the discussion of new ideas. Local groups can focus on motivating change, while certification can also encourage social norms.

Nudging our industry should also be front and centre. Setting targets and working towards them is a way of encouraging broad-scale action. We have seen this in the Sustainable Dairying: Water Accord. Further, industry groups play an important role in bringing people together, encouraging dialogue, and establishing new ways of doing things. This is a key part of moving forward. It is also critical to get all the ducks in a row. Alignment across the industry is critical if working together is to have the greatest impact.

In a world where farming is now everyone’s business, nudging our community is more important than ever. There are two key decisions that can be influenced. First, there is the choice to polarise and blame, without engaging or understanding. Nudges can be valuable here to build trust and transparency. Second, there is the choice of some urban communities to pollute their waterways. How can we nudge them, so that we can improve the quality of these assets? (This topic will be explored more during the workshop session at the conference.)

There is plenty to learn from each other, and plenty to potentially be gained, when we nudge each other.

References


What really goes on under a Urine Patch?

Anna Carlton, Camilla Gardiner, Roshean Woods, Tim Clough
Lincoln University

Key findings from research

- The diet of the animal alters the composition of the urine which can alter how the N is lost from the urine patch
- Increasing non-urea N in urine results in a larger inorganic-N pool in the soil, increasing the likely hood of the greenhouse gas $\text{N}_2\text{O}$ being emitted and nitrate leaching
- Excretion of plant secondary compounds such as aucubin (from plantain) in the urine can reduce nitrification in the soil, slowing down the formation of nitrate, a precursor to denitrification and leaching events.
- Urine from cows fed diets containing plantain had less ammonia oxidising bacteria which reduced ammonia production, so more N stayed in the soil for plants to use for growth
- When plants grow actively during cooler conditions and have a high yield potential – such as Italian ryegrass - soil N is utilised efficiently and nitrate leaching is reduced
- Feeding pastures containing plants which produce potential nitrification inhibitors (aucubin in plantain) and growing winter active species which utilise soil N (Italian ryegrass) can help mitigate N losses

Introduction to the N cycle and the urine patch

Tim Clough
Excess nitrogen (N) in the urine patches creates hot-spots for emissions of the greenhouse gas nitrous oxide ($\text{N}_2\text{O}$), dinitrogen ($\text{N}_2$), and nitrate ($\text{NO}_3^-$) leaching. Nitrous oxide is a potent greenhouse gas and ozone-depleting substance. Dinitrogen represents a potential economic loss with up to 25% of urine-N deposited being lost as $\text{N}_2$ under some soil conditions. Nitrate is a contaminant of waterways and groundwater. Dry matter intake and percentage N in the feed determine the amount of N excreted by the ruminant. As the N intake increases the concentration of N excreted in the ruminant’s faeces remains relatively constant, however, the N concentration in the excreted urine increases. When the urine leaves the ruminant, and is deposited on to the pasture, the bulk of the urine N is in the form of urea. This is commonly deposited onto pasture at a rate that exceeds the pasture’s immediate ability to take up this N (e.g. 700 kg N ha$^{-1}$).

Upon deposition onto the pasture soil the urea is hydrolysed by the enzyme urease, which is common throughout the environment. This transforms the urea-N into ammonium-N ($\text{NH}_4^+$). Other products of this transformation result in a high soil pH occurring ($\sim 9.0$) which makes the $\text{NH}_4^+$ pool susceptible to being lost from the soil as ammonia gas. On average about 10% of the urine-N maybe lost as ammonia (Laubach et al. 2013).
The NH$_4^+$ that remains in the soil may be taken up by plants, fixed by clay minerals or undergo microbial transformation. The first of these microbial transformations is nitrification (Fig. 1). This process results in the NH$_4^+$ pool being oxidised to initially form nitrite (NO$_2^-$). This compound is reactive and toxic to many microbes so it rarely accumulates in the soil and is oxidised though to the more commonly observed NO$_3^-$ molecule. The microbes responsible for nitrification in soil are bacteria and archaea. Bacteria are recognized as being the predominant nitrifiers under ruminant urine patches (Di et al. 2009). If soil conditions become anaerobic then the NO$_3^-$ molecule can be reduced, again by soil organisms, sequentially forming NO$_2^-$, nitric oxide (NO), N$_2$O and N$_2$. In the absence of NO$_3^-$ and/or NO$_2^-$ the denitrification pathway has a limited capacity to generate N gases. Thus mitigating the development of NO$_2^-$ or NO$_3^-$ through the use of nitrification inhibitors is a strategically important area of research for improving N use efficiency while mitigating N losses. Prior research has focused on the use of nitrification inhibitors such as dicyandiamide (DCD). More recently research, discussed below, has also focused on looking at naturally occurring compounds in ruminant urine and forage species being grazed by ruminants.

Figure 1. The soil/plant nitrogen cycle (from Cameron, 1992).

Non-urea urine nitrogen compounds and plant secondary metabolites

Camilla Gardiner

Two novel methods for reducing urine patch N$_2$O emissions were identified and evaluated:
1. Altering urine-N composition to increase the proportion of urine-N excreted as non-urea urine nitrogen compounds (NUNCs). These may be less labile forms of N, capable of stimulating plant-N uptake, or forms of N that degrade to compounds which inhibit nitrification, a key step in soil N₂O production.

2. Pasture species may contain active plant secondary metabolites (PSMs) capable of inhibiting nitrification in soil. After ingesting these PSMs, the animal could potentially excrete them in their urine, thereby directly applying a nitrification inhibitor to the urine patch. The PSM, aucubin, in the pasture herb species *Plantago lanceolata* (plantain) was identified for its potential to inhibit nitrification in the urine patch.

The potential for varying urine-N composition to alter urine patch N₂O emissions was evaluated in two trials: a laboratory trial which tracked the fates of two ^15^N-labelled NUNCs in soil and a field trial which determined the effect of increasing the proportion of urine-N excreted as NUNCs, rather than as urea, on urine patch N₂O emissions. It was found that ^15^N labelled NUNCs rapidly degraded in pasture soil, and that increasing the proportion of urine-N excreted as any of the NUNCs did not alter urine patch N₂O emissions or plant-N uptake. It was concluded that altering the composition of the urine (so that more of urine N is in non-urea form) will not mitigate against greenhouse gas: N₂O emissions.

Aucubin, applied as either a plantain plant leaf extract (PLE) or an aucubin solution (AS), was applied with urine (500-700 kg N ha⁻¹), to mimic livestock excreting this PSM from plantain, in two laboratory and two field experiments. These four experiments determined whether aucubin excreted in urine could reduce urine patch nitrification and N₂O emissions. Soil N₂O emissions were significantly reduced when aucubin was added to urine in both laboratory and field conditions. However, these significant reductions were not consistent over all four experiments. Other indicators of soil nitrification, such as pH and NO₃-⁻N concentrations, showed varying effects of aucubin in the urine patch, with most studies indicating that there was a short window of inhibitory activity 5-10 days after urine application. More research is needed to understand the mechanisms behind the effects of aucubin in the urine patch.

It was concluded that further research of aucubin as a nitrification inhibitor is warranted, due to the varying, yet promising, results observed in the studies. Further research is needed on (i) the input rates and pathways of aucubin into pasture soils via livestock urinary excretion, plantain root exudation, and decomposition of residual herbage, (ii) the fate of aucubin in soil using isotope tracing methods, and (iii) molecular studies to identify the effect of aucubin on soil nitrifiers.

**Effect of forage type on nitrification under the urine patch**

Anna Carlton

Recently, there has been increased interest in the use of plant species, such as plantain, capable of producing secondary plant metabolites which suppress nitrifying microbes in the soil. This is known as biological nitrification inhibition (BNI).

Using soil blocks we measured soil mineral N concentrations (NO₃-⁻N & NH₄⁺-N), and ammonia oxidising archaea (AOA) and ammonia oxidising bacteria (AOB) abundance from urine patches deposited in late summer (February). Cow urine was deposited onto two irrigated forage types, a
diverse forage containing perennial ryegrass, white clover and plantain and a standard forage containing only perennial ryegrass and white clover. Urine collected from cows grazing on a standard forage only was used specifically to test the effect of plant species composition on soil nitrification rates and leaching loss without the confounding factor of different chemical compositions of urine from different forages.

Results suggest that at an N loading rate of 700 kg N ha\(^{-1}\), AOB abundance was lower under the diverse forage containing plantain when compared with the standard forage. Consequently, soil NH\(_4\)-N concentrations remained greater under the diverse forage while soil NO\(_3\)-N concentrations were lower. The lower NO\(_3\)-N concentrations under the diverse forage were attributed to the release of BNI compounds into the soil by the plantain. The results from this trial demonstrate the potential for diverse forages containing plantain to mitigate N leaching losses from cow urine patches deposited onto irrigated grazed pasture.

**Effects of forage type on urine patch N leaching losses**

*Roshean Woods*

One approach to mitigation of N leaching losses from a urine patch is to increase the uptake of N by forage plants, particularly during the cooler seasons when the risk of leaching is greatest. In grazed systems, if plants can utilize urine-N more efficiently at these times of the year, the N lost to drainage water could be reduced. Using lysimeters we measured N leaching losses from urine patches deposited onto the commonly used perennial ryegrass-white clover forage mixture, and some alternative forages: Italian ryegrass, lucerne, and an Italian ryegrass-plantain-white clover mixture.

Results showed N leaching losses for control (non-urine) lysimeters were minimal (<2.2 kg N/ha). When urine was applied, total N leaching losses were 35% lower (\(P < 0.1\)) from Italian ryegrass (133 kg N/ha) and 99% greater (\(P < 0.001\)) from lucerne (407 kg N/ha), when compared with perennial ryegrass-white clover (205 kg N/ha) (Fig. 2) (Woods et al., 2016). The reduction in N leaching for Italian ryegrass, was attributed to it having taken up more N during the winter with 2.1 kg N/ha/day taken up on average, compared with 1.6 kg N/ha/day for perennial ryegrass-white clover, and 0.3 kg N/ha/day for lucerne. Herbage dry matter (DM) yields for the 17-month experimental period were 24 t DM/ha for perennial ryegrass-white clover, 21 t DM/ha for Italian ryegrass and 25 t DM/ha for lucerne (Woods et al., 2016). Please note that we have identified some limitations in the measurement technique used to determine N leaching losses from lucerne due to its deep rooting capability and further research is needed in this area for grazed lucerne stands (see Woods et al. (2016) for more detail).
Figure 2: Total mineral nitrogen (nitrate + ammonium) leaching loss (kg N/ha) from lysimeters for the experimental period: 7 May 2014 to 1 October 2015. Forages were treated in May 2014 with (■) or without urine (●) (at 700 kg N/ha).

Initial results of a second study, show N leaching losses to be around 45% lower from urine (700 kg N/ha) deposited onto an Italian ryegrass-plantain-white clover mixture, compared with perennial ryegrass-white clover. This appears to be again attributed to greater cool-season N uptake. In another treatment, we took into account the N concentration of the urine excreted by dairy cows grazing each of the two forages, and found this was lower for the Italian ryegrass-plantain-white clover mixture (508 kg N/ha) than the perennial ryegrass-white clover (664 kg N/ha). For this treatment, initial N leaching losses were shown to be 89% lower for the Italian ryegrass-plantain-white clover mixture, compared with perennial ryegrass-white clover. There was no difference in herbage DM yield between the two forages.

This research has shown that it is possible to reduce urine patch N leaching losses by optimizing forage growth and N uptake using alternative forages which are more winter-active or reduce urine-N excretion. These are potential tools which farmers could use to reduce N leaching losses into the future.

Acknowledgements

This research was completed as part of the Forages for Reduced Nitrate Leaching programme with principal funding from the New Zealand Ministry of Business, Innovation and Employment and DairyNZ. The programme is a partnership between DairyNZ, AgResearch, Plant & Food Research, Lincoln University, The Foundation for Arable Research, The New Zealand Agricultural Greenhouse Gas Research Centre and Landcare Research.
References


A balancing act – living well and farming well

Dana Carver, Maitland Manning

Summary

- Modern farming has many pressures that require us to be resilient.
- Society focuses more on illness than health. Because of this we often wait until we see symptoms of illness before we change our behaviour. However, resilience comes from focusing on building health to prevent symptoms and stay strong.
- Wellness is directly related to stress so learning to manage stress is key. The healthier we are, the more stress we can handle.
- On-farm we have technical resources and challenges and off-farm we have personal resources and challenges. It’s important to understand the relationship between the two.

Introduction

It’s important to think about wellbeing as part of a larger focus on reducing personal, workplace and business risk. Health, safety, and wellbeing are topics which relate and overlap, however, they are different.

a) Safety is about avoiding accidents
b) Health is about avoiding exposure
c) Wellbeing is about experiencing enjoyment

All of these things contribute to quality of life and everyone within a business is responsible (in part) for all of them. The critical focus is being able to identify and address risk in all three areas.

Your wellbeing is the result of living your life in a particular way. The people you socialise with, the education and learning you seek, the food you eat, the activities you partake in, all contribute to your wellbeing.

Resilience

One of the ingredients for wellbeing is resilience. This is a personal quality that allows individuals to bounce back in the face of challenge or loss. Resilient leaders can often use the experience to not only bounce back but in fact bounce forward.

Modern day farming is a high-pressure environment. The challenges farmers face every day can mount up and stress levels can be intense and endure for long periods of time. Some examples of the types of pressures today’s farmers face are listed below:

- Volatile weather
- Isolation
- Intense workloads
• Volatile commodity prices
• Public perception/Community relationships
• High debt
• Succession planning
• Environment regulations
• Health & Safety regulations
• Staff dynamics (particularly living close to those you work with).

Achieving resilience in your business starts with creating lasting resilient habits. Some examples are below:

• Budgeting well when cash flow is good
• Knowing all critical indicators
• Spending time on what’s important
• Celebrating wins
• Regularly cultivating networks
• Understanding change and constantly learning

Reeves & Allison (2009-2011)

However, it is only possible to create such habits if you have the mental and physical strength to do so. Strength is the fantastic currency you can earn by keeping yourself well. Its provides you with the sharpness you require to act effectively in this forever challenging and changing industry.

Wellbeing & Farming

All industries have pressures and farmers have always had to endure volatile weather and commodity prices as well as isolation and physical workloads. However, modern farming has a number of additional pressures including, high debt levels, staff management and regulations to name a few.

<table>
<thead>
<tr>
<th>Historical pressures</th>
<th>Current pressures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volatile weather</td>
<td>Volatile weather</td>
</tr>
<tr>
<td>Intense physical workloads</td>
<td>Intense physical workloads</td>
</tr>
<tr>
<td>Isolation</td>
<td>Greater isolation (less community)</td>
</tr>
<tr>
<td>Volatile commodity prices</td>
<td>Extreme volatility (with higher impact)</td>
</tr>
<tr>
<td></td>
<td>Intense mental workloads</td>
</tr>
<tr>
<td></td>
<td>High debt levels High staff turnover</td>
</tr>
<tr>
<td></td>
<td>Nutrient and water limitations</td>
</tr>
<tr>
<td></td>
<td>Health and Safety regulations</td>
</tr>
<tr>
<td></td>
<td>Negative public perception</td>
</tr>
</tbody>
</table>
Statistics are showing these pressures are taking their toll with 12% dairy farmers suffering from burnout, nearly 1/4 dairy farmers reporting exhaustion and 1/3 of dairy farmers reporting sleep problems. New Zealand also has 23 farmer suicides each year, nearly 1 a fortnight. Therefore, it’s essential when we are planning our business goals to ensure wellbeing is maintained.

Wellbeing is also correlated with business performance creating 31% higher productivity, 37% more profit and 3 times more ideas and innovation.

**Health and wellbeing basics**

Today’s society has a habit of focusing on illness instead of health. We wait until we see a sign or symptom of something and then we go get treatment. However, true resilience comes from focusing on health so we have the energy to thrive. Often we are just surviving and on the verge of symptoms of illness. When stress rises, those symptoms quickly appear.

Health is not an absolute, it is better described as a continuum. What do you tend to focus on? Some people spend their life striving for health, some spend it fearing illness and some avoid thinking about it altogether until they are so ill they are forced to get help.

Where do you sit now? Where you are on the spectrum currently will influence the actions required to reduce your immanent risk. Everyone’s risks will be slightly different and unique to them as human beings are complex creatures.

If you are just surviving at the moment and something stressful happens you will quickly become ill because you are closer to that spectrum. If you are well and thriving and something stressful happens you are more likely to be resilient and stay well throughout the crisis or high stress period.

**Understanding & Managing Stress**

Wellness is directly related to stress. Different things influence our ability to handle high levels of stress. As mentioned, one is our health, whether we are well and thriving vs. on the cusp of being sick. Another is linked to our values. Are we able to have what’s important to us and live a life in line with our values? Are our values being threatened? (see the section on values and personality for more on this topic).
Another way of managing high stress is understanding the different levels and what prolonged stress can do to us.

There are 4 basic levels of stress to be aware of.

- **Good Stress (Eustress):** Fosters challenge and motivation
- **Excessive Stress:** Mostly creates negative feelings
- **Burnout:** Emotional, mental, and physical exhaustion *caused by prolonged excessive stress.*
- **Mental Illness:** Disorganisation of the mind, and emotions so that normal functioning is impaired.

All of which are risks to you, which means they are a risk to your family and business.

So how do you manage stress? How do you avoid burnout? Firstly, take time for activities which recharge your batteries and give you the strength you need to be resilient. Be proactive about keeping yourself well resourced, not reactive and grabbing at things at the last minute. There are two useful models for considering wellbeing.

**Te Whare Tapa Wha Model**

One model for understanding health is the concept of ‘te whare tapa whā’ – the four cornerstones (or sides) of health. With its strong foundations and four equal sides, the symbol of the wharenui illustrates the four dimensions of well-being. Should one of the four dimensions be missing or in some way damaged, a person, or a collective may become ‘unbalanced’ and subsequently unwell.

---

Prolonged stress can cause

- High blood pressure
- Depression
- Anxiety
- Heart Disease
- A weakened immune system
- Body aches and joint weakness
- Inability to concentrate or complete tasks
- Inability to make decisions
- Inability to stick to a plan
Resources and Challenges Model

On-farm we have resources and challenges. This is no different off-farm where we also have personal resources and challenges. There are four types of personal resources. You will see they match the four walls of the previous model.

1. Physical
2. Mental
3. Social
4. Spiritual

This model considers the importance of having the resources to balance our challenges.

In simple terms much of our life’s risk come down to two things; Challenges and Resources. For example; you may have the challenges of poor soils, the current low pay-out and inadequate accommodation. But, you have the resources of an excellent herd, good rainfall, and the ability to
achieve low residuals. It's no different for wellness or wellbeing, and our resources in this instance can be described by the four aspects of your life which have the potential to recharge your batteries so you have the strength to face challenge and change.

Keep in mind that challenges and resources on farm work together with **personal challenges and resources**. For example, if you have more on-farm challenges during calving, you can balance these with having more personal resources. Below are two examples:

**Example 1**
- Happy and supportive family after great holiday
- Cows milking well and low mastitis
- Feeling physically fit for the season
- A good attitude and focusing on what you can control

**Example 2**
- Understaffed
- Back Pain
- Extremely dry conditions
- New water limitations
- Grief over recent loss of father
- Haven’t caught up with mates in months
- Pressure from shareholders
- Negative public perception
- Teenage child with attitude
## Examples of personal resources and challenges

<table>
<thead>
<tr>
<th>Physical Wellbeing</th>
<th>Resources</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy and Agility</td>
<td>Good sleep</td>
<td>Too much sugar</td>
</tr>
<tr>
<td></td>
<td>Deep sleep</td>
<td>Too much fat</td>
</tr>
<tr>
<td></td>
<td>Consistent sleep</td>
<td>Too much caffeine</td>
</tr>
<tr>
<td></td>
<td>Enough sleep</td>
<td>Too much alcohol</td>
</tr>
<tr>
<td></td>
<td>Getting lots of nutrients</td>
<td>Over-weight/under-weight</td>
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<tr>
<td></td>
<td>Exercise</td>
<td>Injury</td>
</tr>
<tr>
<td></td>
<td>Cardiovascular</td>
<td>Chronic (constant) pain</td>
</tr>
<tr>
<td></td>
<td>Daily movement</td>
<td>Low immunity</td>
</tr>
<tr>
<td></td>
<td>Strength and flexibility</td>
<td>Disease</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mental Wellbeing</th>
<th>Resources</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude, Purpose, and Perspective</td>
<td>Positive attitude</td>
<td>Worry</td>
</tr>
<tr>
<td></td>
<td>Focusing on what you can control</td>
<td>Anger</td>
</tr>
<tr>
<td></td>
<td>Having a clear purpose</td>
<td>Frustration</td>
</tr>
<tr>
<td></td>
<td>Knowing what you value</td>
<td>Confusion</td>
</tr>
<tr>
<td></td>
<td>Ability to respond instead of react</td>
<td>Boredom</td>
</tr>
<tr>
<td></td>
<td>Ability to communicate needs</td>
<td>Loss of perspective</td>
</tr>
<tr>
<td></td>
<td>Time off farm</td>
<td>Inability to concentrate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social Wellbeing</th>
<th>Resources</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work, Home, and Community</td>
<td>Fellow farmers to talk farming with</td>
<td>Conflict with people you work with</td>
</tr>
<tr>
<td></td>
<td>Good business or work relationships</td>
<td>Conflict with people in the community</td>
</tr>
<tr>
<td></td>
<td>A supportive partner</td>
<td>Conflict with friends or family</td>
</tr>
<tr>
<td></td>
<td>A family which brings you joy</td>
<td>Loneliness</td>
</tr>
<tr>
<td></td>
<td>Friends to do things with outside of farming</td>
<td>Excessive demands from partner</td>
</tr>
<tr>
<td></td>
<td>A connection to the industry/community</td>
<td>Pressure/ guilt from friends or family</td>
</tr>
<tr>
<td></td>
<td>An outlet to help others</td>
<td>Feeling misunderstood</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spiritual Wellbeing</th>
<th>Resources</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faith and Appreciation</td>
<td>A belief in something greater</td>
<td>Belief that everything is up to you</td>
</tr>
<tr>
<td></td>
<td>Ability to experience joy</td>
<td>Very few outlets to experience joy</td>
</tr>
<tr>
<td></td>
<td>Appreciation and Praise for life</td>
<td>I view life as a hard, relentless road</td>
</tr>
<tr>
<td></td>
<td>Connection with nature</td>
<td>Stuck indoors and on devices often</td>
</tr>
</tbody>
</table>
Challenges and resources checklist

Tick the column on the right to indicate your personal resources and challenges. Continue into the bottom section if you would like to include on-farm resources and challenges.

<table>
<thead>
<tr>
<th>Resources</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>When I sleep, it is a deep sleep</td>
<td>I eat too much sugar</td>
</tr>
<tr>
<td>I go to bed and get up at consistent times</td>
<td>I eat too much fat</td>
</tr>
<tr>
<td>I get at least 7 hours of sleep most nights</td>
<td>I consume too much caffeine</td>
</tr>
<tr>
<td>I get the nutrients my body needs most days</td>
<td>I eat too much food</td>
</tr>
<tr>
<td>I get adequate cardiovascular exercise</td>
<td>I don’t eat enough</td>
</tr>
<tr>
<td>I get a large range of movement each day</td>
<td>I have an injury and/or constant pain/constant fatigue</td>
</tr>
<tr>
<td>I am strong enough to do my job</td>
<td>I have a diagnosed illness or disease</td>
</tr>
<tr>
<td>I have a positive attitude</td>
<td>I often struggle to concentrate and focus</td>
</tr>
<tr>
<td>I focus on what I can control</td>
<td>I worry a lot</td>
</tr>
<tr>
<td>I have a clear purpose in my work</td>
<td>I am often frustrated or angry</td>
</tr>
<tr>
<td>I know what I value</td>
<td>I often feel lost and confused</td>
</tr>
<tr>
<td>I have a holiday of some kind each year</td>
<td>I am often bored</td>
</tr>
<tr>
<td>I get off the farm regularly</td>
<td>I am over focused on the farm</td>
</tr>
<tr>
<td>I have fellow farmers I can talk farming with</td>
<td>I have conflict with people I work with</td>
</tr>
<tr>
<td>I enjoy the people I work and do business with</td>
<td>I have conflict with people in my community</td>
</tr>
<tr>
<td>I have a partner who supports me</td>
<td>I have conflict with friends and family</td>
</tr>
<tr>
<td>My family brings me joy</td>
<td>I am often lonely</td>
</tr>
<tr>
<td>I feel connected to the industry/community</td>
<td>My family/friends are source of pressure for me</td>
</tr>
<tr>
<td>I have an outlet to help others</td>
<td>Currently my partner is putting a lot of demands on me</td>
</tr>
<tr>
<td>I have faith in a greater power or higher purpose</td>
<td>I often feel misunderstood</td>
</tr>
<tr>
<td>I make an effort to spend time in nature</td>
<td>I am often scared and think the world is against me</td>
</tr>
<tr>
<td>I regularly appreciate the beauty in my life</td>
<td>I spend more time on devices than outdoors</td>
</tr>
<tr>
<td>I meditate or pray</td>
<td>I view life as a hard, relentless road</td>
</tr>
<tr>
<td>I praise or worship with others</td>
<td>I often feel the world is on my shoulders</td>
</tr>
<tr>
<td>I have enough grass/feed</td>
<td>I hide my passions and dreams from others</td>
</tr>
<tr>
<td>The current pay-out is good</td>
<td>The weather is a frequent source of stress for me</td>
</tr>
<tr>
<td>I have a good capable team</td>
<td>The number of things I have to be on top of is tiring</td>
</tr>
<tr>
<td>I am happy with the production I’m getting</td>
<td>I have high debt</td>
</tr>
<tr>
<td>I am happy with my farm’s infrastructure</td>
<td>I am affected by negative perceptions about farming</td>
</tr>
<tr>
<td>I have adequate plant &amp; equipment to farm well</td>
<td>Regulations (Enviro, Health &amp; Safety, etc) are stressful</td>
</tr>
<tr>
<td>I have a good quality herd</td>
<td>I have current animal health issues</td>
</tr>
<tr>
<td>I am happy with my six week in-calf rate</td>
<td>I have poor reproduction results</td>
</tr>
</tbody>
</table>
Reviewing and Planning Worksheet

My three greatest personal resources:

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

I will ensure I maintain these by:

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

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__________________________________________________________________________
My three greatest personal Challenges are:

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

I will turn these challenges into resources by:

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
<table>
<thead>
<tr>
<th>Books</th>
<th>Papers</th>
<th>Website</th>
<th>Apps</th>
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<tbody>
<tr>
<td>Wellbeing: The 5 Essential Elements - Gallup</td>
<td>Good Life Project</td>
<td>farmstrong.co.nz</td>
<td>Fitbit</td>
</tr>
<tr>
<td>Happiness - lessons from a new science - Richard Layard</td>
<td>New Economics Foundation</td>
<td>mentalhealth.org.nz</td>
<td>Happify</td>
</tr>
</tbody>
</table>
SAVE THE DATE

25 26

JUNE 2019
INVERCARGILL

Don’t miss out! Make a note in your diary for next years event. Visit side.org.nz